DOWNTOWN TRAILS CONNECTION

COASTAL TRAIL TO SHIP CREEK

MOA PM&E
PROJECT NO. 14 - 41

FINAL DESIGN STUDY REPORT

MAY 2017

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Abbreviations

AADT	Annual Average Daily Traffic volume (vehicles per day)
AASHTO	American Association of State Highway Transportation Officials
AASHTOGB	AASHTO Geometric Design of Highways and Streets (“Green Book”)
ACMP	Anchorage Coastal Management Plan
ADA	Americans with Disability Act
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AADT	Average Annual Daily Traffic volume (vehicles per day)
ADOT&PF	Alaska Department of Transportation and Public Facilities
AMATS	Anchorage Metropolitan Area Transportation Solutions
AMC	Anchorage Municipal Code
ARRC	Alaska Railroad Corporation
AWWU	Anchorage Water and Wastewater Utility
bgs	Below Ground Surface
CBD	Central Business District
cfs	Cubic foot per second
CMP	Corrugated metal pipe
CSS	Context Sensitive Solutions
DCM	Municipality of Anchorage Design Criteria Manual
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
IBC	International Building Code
kV	kilovolt
Max	Maximum
Min	Minimum
MOA DCM	Municipality of Anchorage (MOA) Design Criteria Manual (DCM)
MPH	Miles per hour
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
Opt.	Option
OS&HP	Official Streets and Highways Plan
PCM	ADOT&PF Pre-Construction Manual
PM&E	Project Management and Engineering
ROW	Right-of-way
sf	Square feet
SWPPP	Storm Water Pollution Prevention Plan
USACE	US Army Corps of Engineers
USFWS	US Fish & Wildlife Services
vpd	Vehicles per day

1. INTRODUCTION AND EXECUTIVE SUMMARY

The Municipality of Anchorage Project Management and Engineering Department (MOA PM&E) has contracted with CRW Engineering Group, LLC (CRW) to provide professional services to evaluate alternatives for connecting the Tony Knowles Coastal Trail (Coastal Trail) to the Ship Creek Trail in downtown Anchorage. This project aims to complete the most high-profile missing link identified in the *Anchorage Areawide Trails Plans* (1997). See FIGURE 1 and FIGURE 2 for Location and Project Vicinity maps. The primary project goal is to connect the Coastal Trail to the Ship Creek Trail but depending on the selected route, the project could also achieve the following secondary benefits:

- Provide direct access between downtown Anchorage and the Ship Creek area attractions
- Provide a destination with direct water-front and coastal access
- Reduce user conflict between pedestrians, bicyclists, Ship Creek anglers, and vehicles
- Reduce the number of Alaska Railroad Corporation (ARRC) track or facility incursions at uncontrolled locations

Some of the major challenges in establishing this missing formal link include:

- ARRC owns most of the property in the Ship Creek area and is currently using it or has plans for future development for it
- All trail connection options will require at least one railroad track crossing
- Large elevation changes exist between downtown Anchorage (Coastal Trail) and the Ship Creek area (Ship Creek Trail)
- Geotechnical constraints include seismically sensitive bluffs and fine-grained silt and soft soils to a depth of 90 feet below ground surface (bgs)
- Mean high water in the area (17.3 feet elevation) and the 100-year flood (19 feet elevation) make crossing beneath the existing bridges challenging. The current railroad track at the Ship Creek bridge crossing has an elevation of approximately 22 feet.
- Rigorous permitting requirements are anticipated for alternatives requiring fill in a coastal area

Project development followed the MOA Context Sensitive Solutions (CSS) process and involved agency, business, and public stakeholders. The design process for selecting a preferred alternative was an iterative process involving meeting with multiple stakeholders and a project working group. A summary of the design alternative development process is presented below.

1. *Level 1 Analysis:* Five options – Red (Opt. E), Orange (Opt. D), Yellow (Opt. C), Green (Opt. B), and Blue (Opt. A) – shown in FIGURE 9, with multiple variations within each option, underwent "high-level" analyses to determine if the alignment was reasonably viable. Stakeholder input was solicited at the 1st Stakeholder Working Group (SWG) meeting and at a public Open House. This effort resulted in the elimination of the:
    a. Orange (Opt. D) route due to the steep grades along Christensen Drive and the congestion at the ARRC Depot
    b. Yellow (Opt. C) route due to its proximity to the planned, but not yet finalized, ARRC Intermodal Transportation Center

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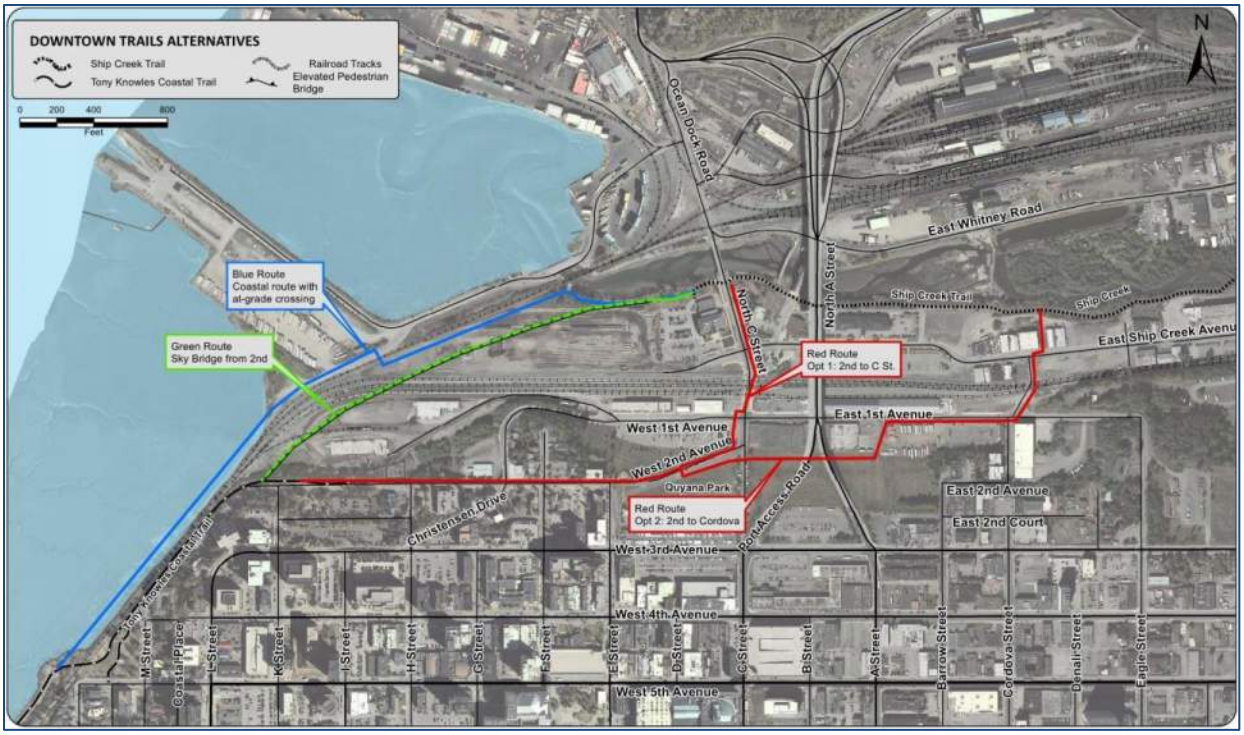
Copy of Figure 9: Level 1 Analysis Options

2. *Level 2 Analysis:* The remaining three alternatives (shown in FIGURE 10) were presented at the 2nd SWG meeting to solicit additional input and comments. These alternatives were also analyzed in more detail with expanded conceptual design.



Copy of Figure 10: Level 2 Analysis Options

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Following the Level 2 Analysis, it was determined that Option 1 of the Red Route and the Green Route both provide the best balance of meeting project needs, providing secondary benefits, minimizing conflicts with multi-modal users or providing appropriate mitigation measures, avoiding drainage issues, and permitting requirements. Thus, two alternatives are recommended:

1. Near term improvements: Red Route, Option 1; estimated construction cost = $2,834,000.
2. Long term improvements, or as soon as funding allows: Green Route; estimated construction cost = $15,095,000 (steel H-truss bridge) to $18,119,000 (pre-stressed concrete box girder bridge).

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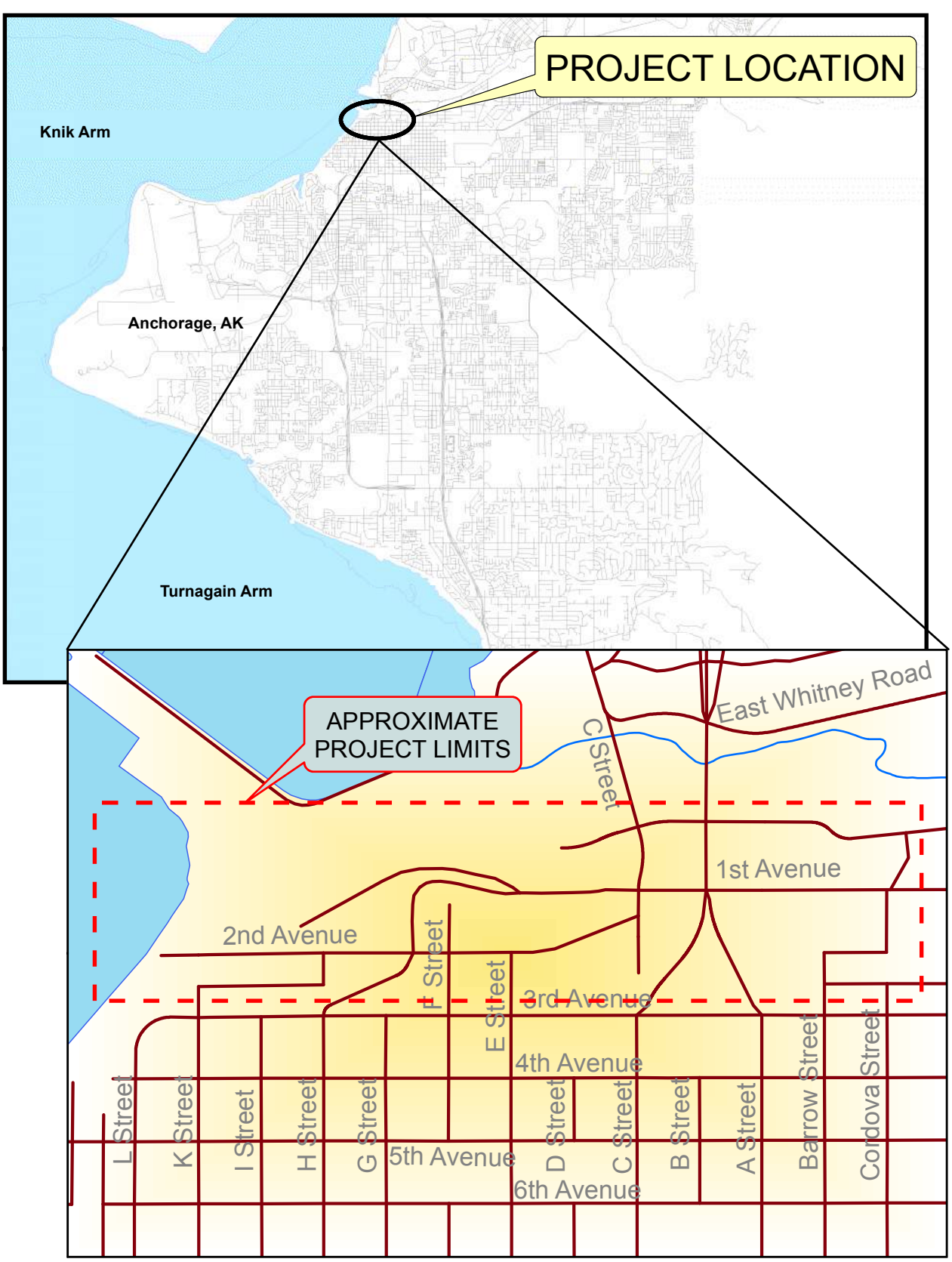

Figure 1 - Project Location Map

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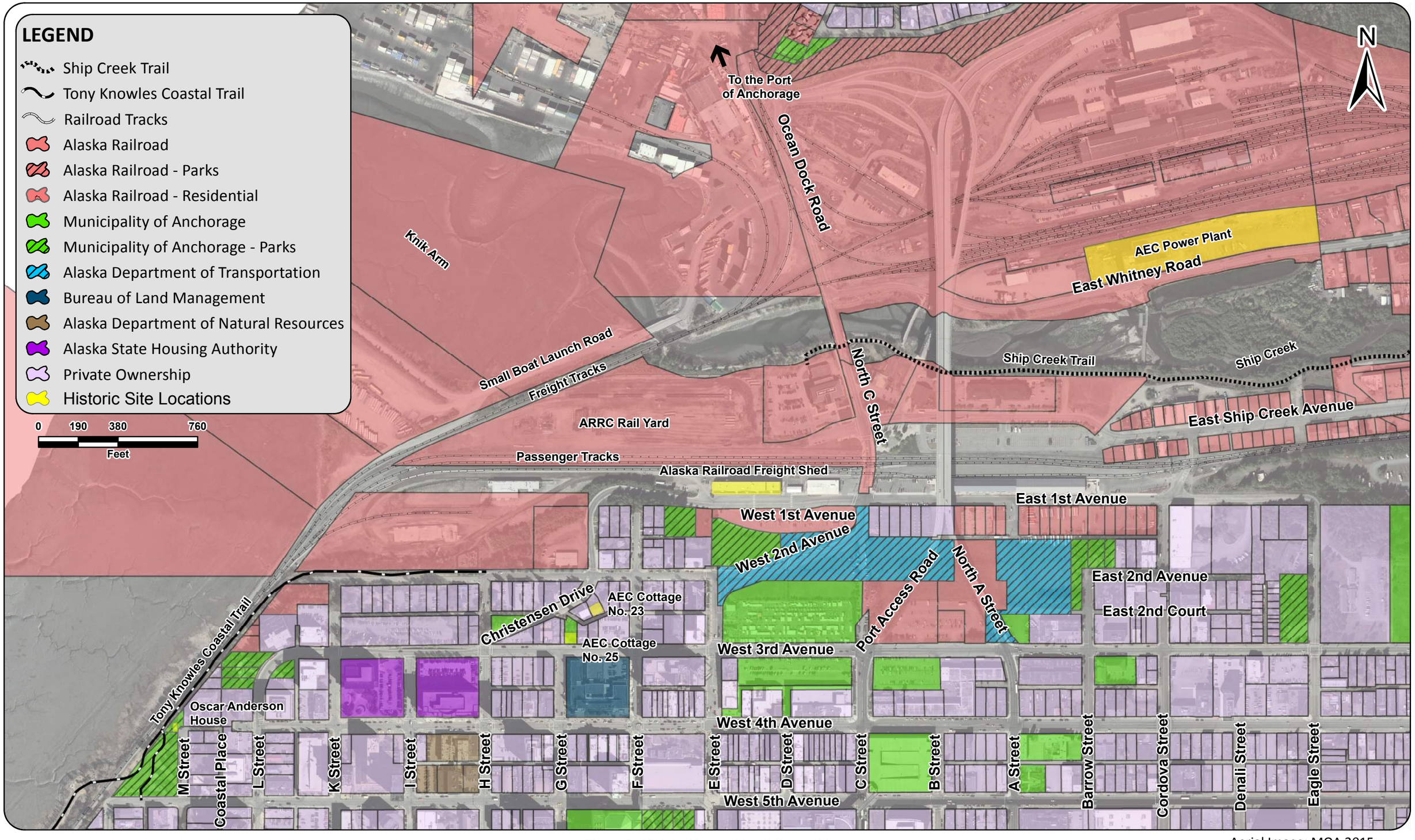

Figure 2 - Vicinity Map and Land Ownership

Aerial Image: MOA 2015

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2. BACKGROUND

2. A. Purpose and Need

The Coastal Trail was constructed in phases during the 1980s and 1990s. The Ship Creek Trail started with a short segment north of the new ARRC Headquarters building and then was constructed to its current terminus at Tyson Elementary School in Mountain View in phases between 2003 and 2008. There is no formal link between these main, multi-use trails.

The Downtown Trails Connection project aims to complete a missing link in Anchorage's trail system by directly connecting the Coastal Trail to the Ship Creek Trail. Additionally, possible connections from the Ship Creek Trail to downtown Anchorage will also be evaluated. Improvements may include widening existing facilities, adjusting the horizontal and vertical alignment along the proposed trail, new pedestrian and bicycle facilities, signage, storm drainage, landscaping, lighting, and utility reconstruction.

Depending on the chosen route, the Downtown Trails could also achieve the following secondary benefits, depending on which route option is selected:

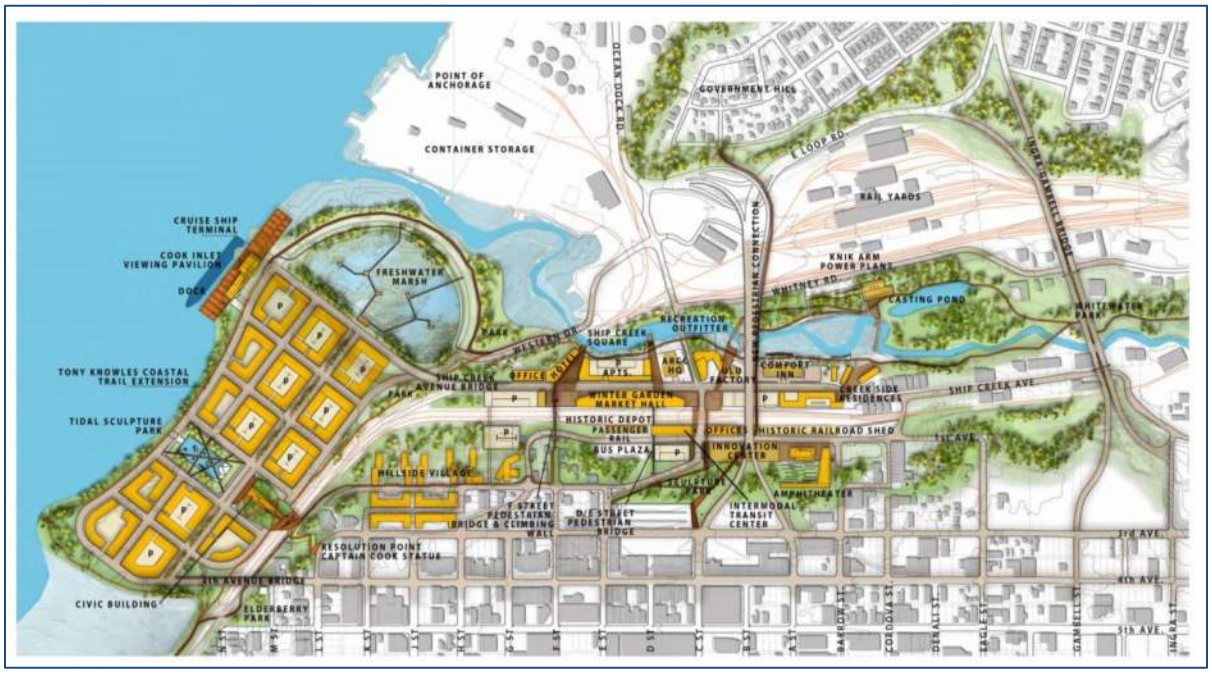
- Provide direct access between downtown Anchorage attractions and Ship Creek area attractions
- Provide access to the Small Boat Harbor
- Provide a destination with direct water-front and coastal access
- Reduce user conflict between pedestrians, bicyclists, Ship Creek anglers, and vehicles
- Reduce the number of ARRC track or facility incursions at uncontrolled locations

Some of the major challenges in establishing this missing formal link include:

- ARRC owns most of the property in the Ship Creek area and is currently using it or has plans for future development for it
- Property ownership of ARRC lands and ADOT&PF land will require extensive coordination and planning
- All trail connection options require at least one railroad track crossing either at-grade, elevated, or below grade through a tunnel
- Large elevation changes exist between downtown Anchorage (Coastal Trail) and the Ship Creek area (Ship Creek Trail)
- Vehicles, busses, trains, freight trucks, pedestrians, anglers, and bicycles all utilize the Ship Creek area
- Geotechnical constraints include the seismically sensitive buttress area between 3rd and 1st Avenues and fine grained silts and Bootlegger Cove clay to a depth of 90 feet below ground surface (bgs)
- Groundwater is typically encountered 10 feet to 20 feet bgs. It has been reported as shallow as 3 feet bgs at the rail yard.
- Mean high water in the area (17.3 feet elevation) and the 100-year flood (19 feet elevation) make crossing beneath the existing bridges challenging. The current railroad track at the Ship Creek bridge crossing has an elevation of approximately 22 feet.
- Rigorous permitting requirements are anticipated for any alternative that requires placement of fill within a coastal area

2. B. Guiding Plans

The Ship Creek area has been identified as a target for redevelopment in multiple plans, including the *Anchorage Downtown Comprehensive Plan (2007)* and the *Ship Creek Framework Plan (2014)*. Both of these plans specifically mention a priority project of connecting the Coastal Trail to the Ship Creek Trail. The *Ship Creek Framework Plan*, which updates the *1991 Ship Creek Waterfront and Land Use Plan*, proposes connecting these trails by both the waterfront extension of the Coastal Trail as well as pedestrian bridges over the railyard at F Street and at D/E Street. The multiple routes provide both waterfront access and direct pedestrian connections from downtown to the Ship Creek area.



Example of the illustrated overview of the Ship Creek Area from the Ship Creek Framework Plan

The *2014 Ship Creek Framework Plan* carries forward the same goals and objectives as the *1991 Ship Creek Waterfront and Land Use Plan*:

- Goal #1: To revitalize portions of the Ship Creek/Waterfront area and support its growth into a viable, tourist-related, people oriented commercial development.
- Goal #2: To respond to the needs of local residents and tourists for public access to the water, night as well as daytime activities and year-round activities to maximize the use and enjoyment of the Creek and Waterfront for all.
    - Objective: Develop a pedestrian circulation system that includes constructing a trail along Ship Creek to meet the extension of the Coastal Trail and that also ties in to Ship Creek Point.
- Goal #6: To integrate the waterfront and Ship Creek into the fabric of the Municipality.
    - Objective: Construct a direct and pleasant pedestrian link between the Downtown and Ship Creek to promote more intensive use of Ship Creek.

Connecting the Ship Creek Trail to the Coastal Trail is also mentioned as a priority project in the *Anchorage Bowl Park, Greenbelt, and Recreation Facility Plan (2006*), the *Anchorage Pedestrian Plan (2007)*, the *Areawide Trails Plan (1997)*, and the *Ship Creek Multi-Modal Transportation Plan (2007)*.

Additional planning documents, their goals, policies, and recommendations are discussed below.

Anchorage 2020: Anchorage Bowl Comprehensive Plan (2001) (Comprehensive Plan) – The *Comprehensive Plan* sets forth the goals, objectives, and policies for growth in Anchorage for a 20 year planning horizon. It includes land use and transportation goals that are necessary to ensure orderly growth patterns and efficient transportation networks. The policies that guide this project include:

- Policy 37: "Design, construct and maintain roadways or rights-of-way to accommodate pedestrians, bicyclists, transit users, the disabled, automobiles, and trucks where appropriate."
- Policy 38: "Design, construct and maintain roadways or rights-of-way to promote and enhance physical connectivity within and between neighborhoods."
- Policy 45: "Connect local activity centers, such as neighborhood schools and community centers with parks, sports fields, greenbelts, and trails, where feasible."
- Policy 64: "The Municipality shall provide orderly development within Anchorage's coastal zone, protect and enhance its unique natural features and resources, and sustain and enhance coastal access.
- Policy 66: "Fish, wildlife, and habitat protection methods shall be addressed in land use planning, design, and development processes."
- Policy 67: "Critical fish and wildlife habitats, high-value wetlands, and riparian corridors shall be protected as natural open spaces, wherever possible."
- Policy 70: "The ecological and drainage functions of Anchorage's aquatic resources shall be protected and, where appropriate, restored."
- Policy 75: "The first priority for uncommitted municipal lands shall be to serve documented or projected needs for municipal facilities, including schools, parks, sports fields, and open space."

The *Comprehensive Plan* identifies the project area as located in the Northwest subarea; more specifically, the project area is within and borders the Central Business District (CBD). In Chapter 5, Plan Implementation, the Comprehensive Plan recommends "providing for a range of modes of accessibility to/from/and within the CBD…in order to promote the CBD as Anchorage's center of business, government, and cultural…" The *Comprehensive Plan* also recommends improving access to the coastal areas within the Anchorage bowl by extending the Coastal Trail both north and south.

2035 Metropolitan Transportation Plan (MTP) – The *MTP* provides the policies to implement Anchorage's transportation goals and provide for an efficient transportation network for the movement of people and goods. The *MTP* recommends connecting the Coastal Trail to the Ship Creek Trail with a separated pathway.

2010 Anchorage Bicycle Plan (Bicycle Plan) – The *Bicycle Plan* guides the development in regards to providing a complete bicycle network. One of three components of the Anchorage Non-Motorized Plan, the *Bicycle Plan* works in conjunction with the *Anchorage Pedestrian Plan (2007)* and the *Areawide Trails Plan (1997)* to meet the needs of the non-motorized user throughout Anchorage. The *Bicycle Plan* designates three bicycle facilities in the project area:

- A multi-use separated trail to connect the Coastal Trail to the Ship Creek Trail
- A shared use roadway along 2nd Avenue to Christensen Drive to 1st Avenue and C Street
- A shared use roadway along Cordova Street from 3rd Avenue to Ship Creek Trail

The separated pathway to connect the Coastal Trail to the Ship Creek trail is listed as a Priority A project.

Ship Creek District Design Guidelines (2005) – Development within the Planned Community (PC) area of Ship Creek require review by the Ship Creek District Review Board in addition to the Planning and Zoning Commission (PZC). The *Ship Creek District Design Guidelines* apply to all development in the Alaska Railroad's Ship Creek District. These guidelines focus on promoting development that incorporates an "active rail yard, people, a major urban salmon stream together with landscape architecture, architecture, and art into an area that is distinctly Alaskan and Anchorage." Goals and guidelines in the Design Guidelines that directly relate to this project include:

- Seek opportunities to establish pedestrian connections between Ship Creek and Downtown.
- Establish a primary public plaza to serve as the "heart" of the district located at or near the intersection of Ship Creek Avenue and North C Street.
- A greenbelt should be maintained along both sides of Ship Creek and provide for safe and secure pedestrian access to the creek for fishing, while protecting stream bank erosion.
- Design all District streets to accommodate automobiles, transit, bicycles, and pedestrians equitably.
- To encourage a pedestrian focus, street lane widths within the District should be narrow, while still meeting design standards.
- The extension of the Ship Creek Trail is a valuable resource for biking, walking, fishing, and interpretation.

Anchorage Coastal Management Plan (ACMP) (2007) – This document defines issues and guides the development of areas within the Anchorage Coastal Zone boundary, which is defined as all lands within (1) a zone extending 1,320 feet inland from the 100-year coastal flood plain or (2) the 100-year flood plain or 200-feet, whichever is greater, of each river and stream intersected by the coastal zone. The *ACMP* "encourages the protection of important fish and wildlife habitats, high value wetlands, and riparian zones" but it also aims to "promote and maintain access opportunities to coastal areas for purposes of recreation, tourism, coastal development, and transportation and utilities."

The *ACMP* emphasizes the importance of recreation and tourism for the economy and how it relates to coastal access. Tourism is the second largest private-sector employer in Alaska, accounting for one in eight private sector jobs. To promote the tourism industry, the Coastal Trail is identified as a "designated area", important for "recreational use, fish and wildlife habitat, wildlife viewing, and scenic views." Additionally, the lower Ship Creek Valley is identified as an area where the "uses and activities are economically or physically dependent on a waterfront location and these uses and activities must be given priority."

The following enforceable policies (EPs) are applicable to the Downtown Trails project:

- *EP-1 Uses, Activities, and Setback:* Recreational uses are permitted provided they have a 50-foot setback from the Ordinary High Water, unless there is no practicable alternative location.

- *EP-3 Waterfront Development:* water-related uses and activities include pedestrian-oriented access that provide access to and/or views of the shoreline.

Anchorage Original Neighborhoods Historic Preservation Plan (HPP) (2013) – The *HPP* focuses on preserving and managing the historic character of Anchorage's four original neighborhoods (Government Hill, Downtown, South Addition, and Fairview) while planning for a sustainable future. Although the Ship Creek area is not technically one of the four original neighborhoods (it does not have its own community council), this area overlaps three of the four neighborhoods and thus is included in the HPP.

Anchorage Trails Initiative – Signage and Wayfinding Plan (2016) – This signage and wayfinding plan is one element of the Anchorage Trails Initiative, which is one of the focus areas of the Anchorage Economic and Development Corporation's Live.Work.Play Campaign. Some of the main goals of the Wayfinding Plan include:

- Project consistent image for trails and pedestrian routes
- Safely guide residents and visitors to landmarks, facilities, and community services
- Brand neighborhoods and establish a strong sense of place and community pride
- Improve community health by encouraging walking, bicycling, and public transit

The Anchorage Community Land Trust is currently partnering with the Anchorage Parks Foundation to design, create, and install new wayfinding signs along the Ship Creek Trail from the terminus of the trail at Tyson Elementary to the start of the Glenn Highway Bike Trail at Davis Park. This will be the first project completed as part of the *Signage and Wayfinding Plan*.

Freight Mobility Study (Draft, 2016) – This study, which is currently being updated, aims to prepare for the future growth of Anchorage within the Anchorage Metropolitan Area Transportation Solutions (AMATS) area and surrounding communities that depend on Anchorage's multimodal freight transportation network. Within the Downtown Trails project area, the draft study has identified C Street and Whitney Roads as critical roadways to the distribution of good to/from the Port of Anchorage.

The draft study has also identified the following "immediate" (0-10 year time frame) projects within or near the Downtown Trails project area:

- Additional and improved connections to the Ship Creek and Port of Anchorage area
- Reconstruct 3rd Avenue to better accommodate 53-foot long trailers
- Improve Ocean Dock Road access and crossings from the Port of Anchorage to Terminal Road
- Upgrade Whitney Road to address size, turning movements, lack of shoulders, and trail/pedestrian/fishing concerns
- Construct a ramp at Ship Creek at C Street/Ocean Dock Road

3. PROJECT APPROACH & PUBLIC INVOLVEMENT

To meet the needs and goals of the project and follow the recommendations in the guiding plans, this Design Study Memorandum (DSM) evaluates alternatives to connect the Coastal Trail to the Ship Creek Trail. The No-Build alternative was not considered in this report as it is not in agreement with the guiding plans.

Using the MOA Context Sensitive Solutions process as a guideline, agency, business, and public stakeholders were involved in the identification of possible route options for connecting the Coastal Trail to the Ship Creek Trail. A Stakeholder Working Group (SWG) was formed to gather input from key stakeholders during the early phase of the project. The SWG included representatives from MOA PM&E, Anchorage Water and Wastewater Utility (AWWU), MOA Traffic Department, Anchorage Metropolitan Area Transportation Solutions (AMATS), Alaska Trucking Association (ATA), Alaska Department of Fish & Game (ADF&G) Sportfish Division, MOA Parks and Recreation Department, Alaska Railroad Corporation (ARRC), Alaska Department of Transportation & Public Facilities (ADOT&PF), and Port of Anchorage.

The first of two SWG meetings was held on July 28th, 2016 to introduce the project, identify possible options, and gather input and comments. Five route options, with multiple alignment variations, were identified from the first SWG. (See SECTION 16. ALTERNATIVES ANALYSIS for more information on the route options and analysis.) A Public Open House was then held on October 20th, 2016 to gather input from the public on the route options and variations. Approximately 75 public stakeholders attended the project open house. A news article was published in the Anchorage Daily News (ADN) about the project on October 19th, 2016.

Sixty two public comments were received during or after the public open house. Stakeholders generally support constructing the project but also expressed a concern with spending construction dollars on trails during the fiscally difficult times. Many stakeholders supported the idea of a near-term alternative and a future alternative based on available funding. They also commented on wanting the selected route to avoid steep hills and tunnels but noted the benefit of providing coastal access for recreation and user enjoyment.

Comments and input from the first SWG, ADN article, and the Public Open House were combined with engineering analysis to eliminate two options and multiple variations (see SECTION 16. ALTERNATIVES ANALYSIS). The remaining alternatives were presented at the second SWG meeting, held on December 7th, 2016 to gather input and comments. These alternatives have been carried forward for further detailed analysis in this DSM.

Meetings were advertised through invitation for the SWG and through email contact lists and the public project website for the Open House. Additionally, the ADN article listed the information for the public open house. TABLE 1 below summarizes the public involvement during the DSM effort and comments received can be found in APPENDIX C. The CSS process will continue throughout the design phase of the project with additional opportunities for stakeholders to obtain information and provide feedback through the web page, e-newsletter updates, open houses, community council presentations, and direct feedback through meetings, phone calls, and e-mail.

Table 1. Public Involvement Summary to date

Public Involvement Tool/Activity	Date
Establish project website	May 2016
Stakeholder Working Group (SWG) invitations	June 2016
SWG Meeting #1	July 2016
Downtown Community Council meeting	September 2016
Government Hill Community Council meeting	September 2016
South Addition Community Council meeting	September 2016
Public Open House #1 invitations (email, postcard)	October 2016
Public Open House #1	October 2016
SWG Meeting #2	December 2016

4. DESIGN CRITERIA

The MOA PM&E Design Criteria Manual (DCM) provides design criteria for trails and roadways developed within the MOA using local or state funds and the ADOT&PF Pre-Construction Manual (PCM) provides design criteria for trails and roadways developed within ADOT&PF right-of-way.

4. A. MOA Design Criteria

The Anchorage Bicycle Plan designates two types of bicycle facilities in the project area: 1) multi-use separated trail and 2) shared use roadways. Design variances require approval from the Municipal Engineer and the MOA Traffic Department for recommended solutions that cannot meet the DCM requirements.

4. A. 1. Separated Trail Design Criteria (MOA)

TABLE 2 Table 3 shows the design criteria for a separated trail.

Table 2. Paved, multi-use, separated trail design criteria (MOA)

Criteria	Value	Source
Design speed	20 mph (flat grades ≤ 4%) 30 mph (grades > 4%)	DCM 4.2
Horizontal radius	100 feet (for 20 mph design speed) 225 feet (for 30 mph design speed)	DCM 4.2
Stopping sight distance[1]	125 feet	DCM 4.2
Grades (ADA compliant)	5%, except for short lengths as outlined in Section 4.2 E	DCM 4.2
Cross slope	2%	DCM 4.2
Clearances	12 feet wide x 12 feet high	DCM 4.2
Railing, fences	54 inches high, min (for bicycles)	DCM 4.2
Width[2]	8 feet – 10 feet, + 2 foot shoulders each side	DCM 4.2
Shoulders	2 feet minimum, graded at 3%-5% maximum	DCM 4.2
Clear zone	3 feet from edge of travelled surface	DCM 4.2
Separation from roadway	7 feet (when adjacent to a collector road or higher)	DCM 4.2
Bridges	14 ft. wide and rated for a 12,000 lb vehicle	DCM 4.2

1. Stopping sight distance on grades shall be calculated per the equation given in 4.2 C
2. For expected trail volumes over 1,000 users per day or for separated ROW trails, the paved trail width should be 10 feet with 3 feet shoulders.

4. A. 2. On-Street Bike Facilities Design Criteria (MOA)

Bicycle Lanes – Bicycle (bike) lanes are one-way facilities that travel in the same direction as the adjacent vehicle traffic. The bicycle lane is the preferred on-street bicycle facility for major collector roads and arterials. Since bike lanes are dedicated travel lanes for bicyclist only, not pedestrians, they should only be designated on streets with adjacent pedestrian facilities.

Within the Central Business District (CBD), riding bicycles on sidewalks is prohibited, but the project area is just north of the CBD.

Bike lanes should always be placed on both sides of a two-way street and include proper signing and striping. On one-way streets, bike lanes should generally be placed only on the right side of the roadway because the left side, with its contraflow movement, is unfamiliar and unexpected for most motorists. If there is heavy bus traffic or unusually high turning movements on the right, a left side bike lane on a one-way street may be considered.

The proper treatment for bicycle lanes at intersections is important to reduce conflicts between motorists and bicycle users. Good intersection design will indicate what route road and bicycle users should follow and who has the right-of-way. The *AASHTO Guide for Development of Bicycle Facilities* recommends intersection striping configurations for varying intersection layouts.

Shared-use roadways – These are typically located only on low volume local roadways. Shared-used roadways help complete the bike network by using existing roadways to provide connections between major bicycle facilities. While low-travel residential streets would not normally be striped for bicycle lanes, marked bicycle infrastructure on these streets can help with the bike network connectivity. Signing local roadways as shared-use roads or bicycle routes indicates that there is an advantage to the bicyclist to use this route and that actions have been taken to ensure these roadways are suitable for bicycling.

Bike Boulevards – Bike Boulevards are another on-street bike facility option. These facilities are shared-use roadways with low vehicle traffic volumes and are striped and signed to give preference to bicycles, not vehicles.

TABLE 3 shows the design criteria for each type of on-street facility.

Table 3. On-street bicycle facility design criteria (MOA)

Criteria	Value	Source
User	"local" (novices, children, people not comfortable riding in traffic)	DCM 4.4
Paved shoulder[1] width	4 feet (does not include gutter pan)	DCM 4.4
Lane width, when no shoulders are provided	14 feet 15 feet when grades are 5% or more	DCM 4.4
Bike lane[1] width	5 ft. 6 ft. – 8 ft. when adjacent to a parking lane	AASHTO Guide for the Development of Bicycle Facilities

1. AASHTO clarifies that a paved shoulder is not a designated bike lane and thus can be used by pedestrians and for parking. A Bike Lane is a designated travel lane for bicycles only.

4. B. ADOT&PF Design Criteria

ADOT&PF identifies five basic types of facilities that can be used to accommodate bicyclist: shared lane, shoulder, wide outside lane, bike lane, and separated bike (or shared use) pathway.

ADOT&PF design standards in the PCM, and by reference, the *Guide for the Development of Bicycle Facilities ("Guide"),* AASHTO, 2012 and *FHWA RD-92-073* that apply to this project are summarized in TABLE 4 and TABLE 5.

Table 4. On-Street Bicycle facilities design criteria (ADOT&PF)

Criteria	Value	Source
Design Class	Class A (advanced) riders	PCM 1210.3.3
Shared Lane: Vehicle speed Lane width	 30 mph max. 12 feet min.	FHWA-RD-92-073
Shoulder: Vehicle speed Shoulder width No curb Curbed road	 40 mph max. 4 feet min. 5 feet min, from face of curb	"Guide" and FHWA-RD-92-073
Wide outside lane: Lane width	 14 feet min.	"Guide" and FHWA-RD-92-073
Bike lane: Lane width Location	 5 ft. min. (4 ft. min. should be left of gutter) Between the travel lane and parking lane	"Guide" and FHWA-RD-92-073

1. "Guide" = Guide for the Development of Bicycle Facilities

Table 5. Separated, shared use bicycle facility design criteria (ADOT&PF)

Criteria	Value	Source
Width	10 feet min. (2 way travel), 12 ft. preferred	"Guide"[1]
Location	Separated 5 feet min. from face of curb	"Guide"[1]
Design speed	18 mph (grades <2%) 30 mph (sustained grades >6%)	"Guide"[1]
Horizontal radius	60 feet (for 18 mph design speed) 166 feet (for 30 mph design speed)	"Guide"[1]
Cross slope	2%	"Guide"[1]
Grade	5%, except when the shared use path runs along a roadway with a grade that exceeds 5%, the side-path grade may match the roadway grade	"Guide"[1]
Stopping sight distance	Use tables in Section 5.2.8 based on grades	"Guide"[1]
Bridge	Pathway width + 2 foot shoulders each side	"Guide"[1]

1. "Guide" = Guide for the Development of Bicycle Facilities

5. TRAFFIC CAPACITY AND CRASH ANALYSIS

5. A. Existing Traffic Analysis

Existing traffic volumes for the project area were obtained from the ADOT&PF Average Annual Daily Traffic (AADT) counts (2012 through 2014) online GIS database. The existing traffic volumes are shown below in FIGURE 3.

Crash records were obtained for the 10 years from 2005 – 2014. ADOT&PF provides statewide average crash rates at a variety of segment or intersection configurations, based on number of roadway approaches and traffic control type. The average crash rate represents the approximate number of crashes that are "expected" at a study intersection which could be attributed to chance. This average does not account for factors such as sight distance, speed, and number of lanes.

The critical crash rate was then calculated for each roadway segment or intersection using the ADOT&PF Highway Safety Improvement Program (HSIP) Manual methodology. Locations with crash rates that exceed the critical rate are inferred to be above the average crash rate and are not likely due to chance.

Per the ADOT&PF HSIP Manual, intersections are flagged for further review when the safety index is greater than or equal to 0.9, or if the intersection has experienced one fatal or two major injuries in the past 5 years. TABLE 6 and TABLE 7 below summarize the crash records for roadway segments and intersections, respectively.

Table 6. Road Segment Crash Summary

Roadway Segment (location)	Posted Speed (mph)	Total Crashes (2005-2014)	Injury Crashes	Crash Rate[1] (Crashes/ MVM)	State Average[1] (FFY 2017 HSIP)	Critical Crash Rate[1] @ 95% Confidence	Safety Index[1] (crash rate/critical crash rate)
Christensen Drive (1st Ave. to 2nd Ave.)	25	7	1 (major) 4 (minor)	2.90	1.60	3.15	0.92
C Street (1st Ave. to Whitney Rd.)	25	5	1 (minor)	2.46	1.60	3.31	0.74
1st Avenue (Christensen Dr. to Cordova St.)	25	5	1 (minor)	1.24	1.60	2.76	0.45
2nd Avenue (K St. to C St.)	25	7	0	1.36	1.60	2.61	0.52
Ship Creek Ave. (C St. to Eagle St.)	25	6	1 (major) 2 (minor)	3.14	1.60	3.37	0.93
Cordova Street (2nd Ave to Ship Creek Ave.)	25	7	1 (minor)	*No volume data available*			

= Above Statewide Average Crash Rate and Safety Index threshold (0.9).

1. Included if traffic volume data was available
MVM = Million Vehicle Miles

Table 7. Intersection Crash Rate

Intersection	Total Crashes (2005-2014)	Injury Crashes	Crash Rate[1] (Crashes/ MEV)	Control	State Average[1] (FFY 2017 HSIP)	Critical Crash Rate[1] @ 95% Confidence	Safety Index[1] (crash rate/critical crash rate)
2nd Avenue & Christensen Drive	6	0	0.57	2-way stop (4 approach)	0.55	0.97	0.59
2nd Avenue & F Street	2	1 (minor)	-	2-way stop (4 approach)	*No volume data available*		
C Street & 1st Avenue	10	2 (minor)	0.55	2-way stop (4 approach)	0.55	0.87	0.64
C Street & Ship Creek Avenue	6	1 (major) 2 (minor)	0.44	2-way stop (4 approach)	0.55	0.91	0.48
2nd Avenue & Cordova Street	1	0	-	No control (Y-intersection)	*No volume data available*		

1. Crashes/Million Entering Vehicles (MEV) included if traffic volume data was available
MEV = Million Entering Vehicles

Of the 62 crashes in the project area, 4 crashes occurred with pedestrians or bicycles. Of those, only 1 was cited as "at-fault" by the vehicle. The four crashes with pedestrians or bicycles are summarized below.

- Crashes with bicycle:
    1. At intersection of C St. & W. 1st Avenue: stop sign violation by vehicle, minor injury
    2. On Christensen Dr. near 1st Avenue: bicyclist riding on left side of road struck by vehicle (cyclist cited as at-fault), major injury
- Crashes with pedestrian:
    1. On Ship Creek Avenue, near Cordova Street: "asleep" pedestrian struck by vehicle (pedestrian cited as at-fault with DUI), major injury
    2. On Cordova Street, north of 2nd Avenue: pedestrian (age 8) failure to yield, minor injury

Cordova St. looking west to 2nd Ave.

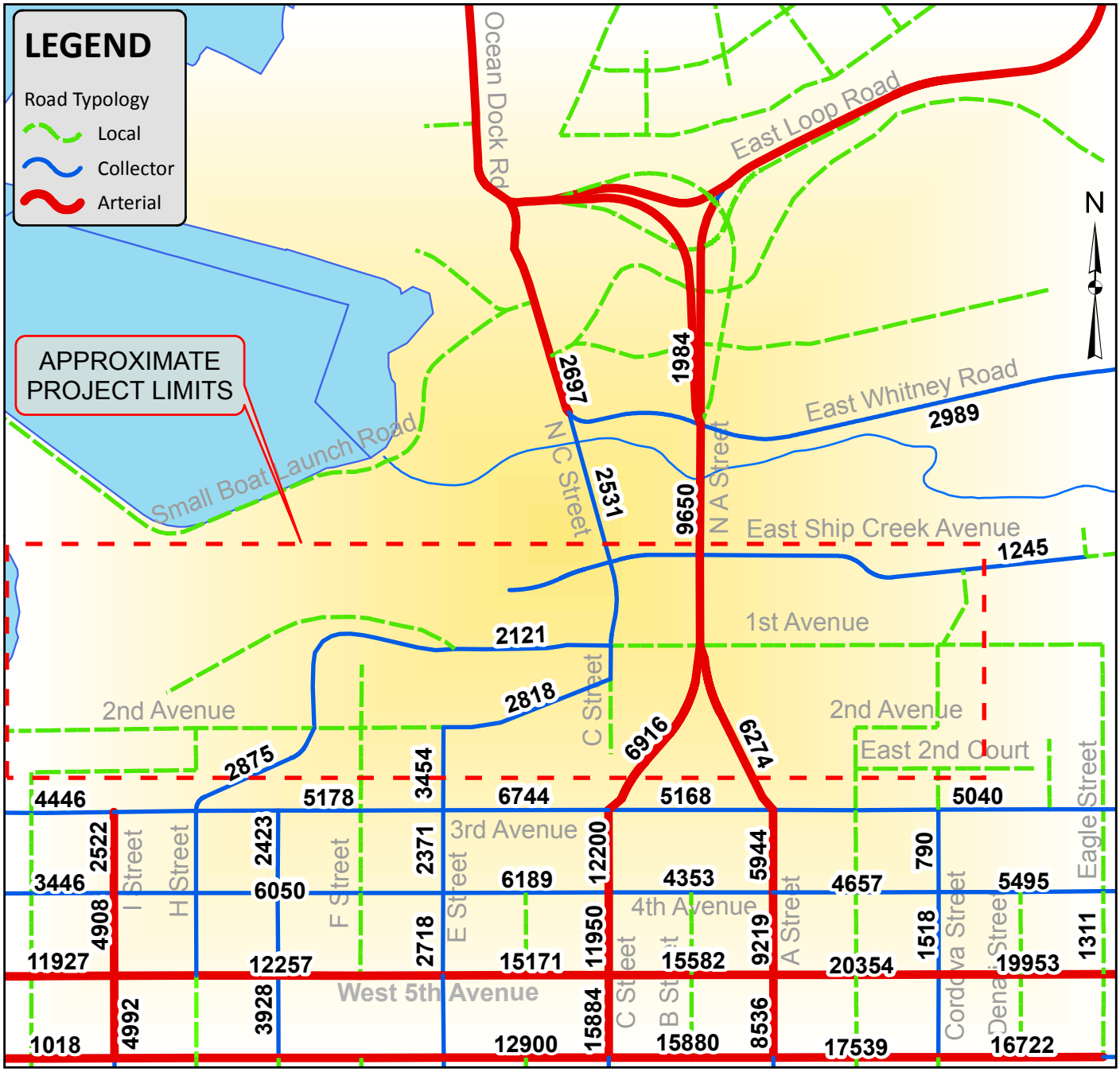


Figure 3 - AADT VOLUMES

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5. B. Non-Motorized Volumes

Pedestrian and bicycle volume counts were not completed at part of this project because the need to provide a connection from the Coastal Trail to Ship Creek Trail and Downtown were established in numerous previous studies. Additionally, existing volume counts would not accurately reflect the anticipated user volumes as this is a new connection.

Stakeholder input as well as "heat" maps from on-line social networking cycling and running applications (Strava) indicate that bicyclist and runners are currently using Christensen Drive and 2nd Avenue to travel between Downtown Anchorage and Ship Creek.

5. C. Future Traffic Projections

Although the majority of the parcels that can be developed in the project area are already developed, the *2014 Ship Creek Framework Plan* shows goals for re-development of the Ship Creek Area. The ARRC has current plans to re-develop two parcels located between W. 2nd Avenue and the railroad tracks to the north. This may include extending W. 1st Avenue to the west. The ARRC also published an Environmental Impact Assessment in 2007 for constructing a Ship Creek Intermodal Transportation Center between W. 1st Avenue and Ship Creek Avenue. Redevelopment of the Ship Creek area could change the traffic patterns and volumes within the project area.

6. RAILROAD CROSSING

Crossing the existing railroad tracks is one of the major challenges of this project. Every option and alternative studied requires crossing at least one railroad track. ERailroad crossing design criteria from the *Technical Standards for Roadway, Trail, and Utility Facilities in the ARRC Right-of-Way (2014)* are summarized below in TABLE 8.

Table 8. Railroad accommodation design criteria

Criteria	Value	Notes
Railway clear zone[1]	25 feet either side of center line of track for an elevation of 23.5 feet (measured from top of rail)	On the outside of horizontal curves, the horizontal clear distance is increased by 5 feet per degree of curvature, for a maximum of 95 feet
Separation from tracks	50 feet from track centerline line, minimum	If the design speed of the track at the crossing is 25 mph or less, a separation of 25 feet from centerline of track may be granted. Bridge piers for elevated crossings may be allowed a separation of 15 feet
Future track accommodations	All facilities constructed on ARRC property are required to accommodate the construction of at least one future track adjacent to the existing track(s)	The spacing of tracks in normally 16 feet (center to center)
Separation from ARRC structures	25 feet minimum	e.g. for bridges
Pedestrian trespass measures	6 foot fence or 12 foot wall	Trespass measures shall be the full length of the pedestrian facility

1. The railway clear zone is the three-dimensional clear area for operations and maintenance of track facilities.

Track crossings can be accomplished in one of three ways: at-grade with the track, elevated/overpass crossing over the tracks, or below grade/underpass crossing. General design requirements for each crossing type are discussed below and also in further detail in SECTION 15. ALTERNATIVES ANALYSIS.

6. A. At-grade railroad crossing

At-grade railroad crossings put the pedestrian/bicyclist at the same elevation (“at-grade”) as the railroad track. At-grade crossings are the least expensive to construct because they do not require large infrastructure but they do require extra safety and precautionary measures to prevent collisions between trains and trail users. At-grade railroad crossings already exist in the project area at C Street and Cordova Street. Existing at-grade crossings that are not compliant with current standards and safety measures for trail crossings, such as at Cordova Street, should be upgraded to meet standards. Safety measures can include:

- Signage
- Flashing lights
- One-way swing gates to prevent entry during active train crossing
- Pedestrian routing fences to slow bicycle crossing speed and require conscious crossing maneuvers and attention to surroundings
- Pedestrian barricades to channelize pedestrians to only cross at desired location
- Pre-emptive automated gates and lights to minimize queues and "in-between" decision points

Existing safety measures at the track crossing at North C Street (from Google Earth)

The railroad crossing at C Street includes automated gates with flashing lights, signing, and striping for the roadway and pedestrian routing fences, pedestrian barricades, and signing for the sidewalks. The railroad crossing at Cordova Street includes automated gates with flashing lights, signing, and striping for the roadway. There are no pedestrian facilities along Cordova. Additional ARRC requirements for at-grade railroad crossing are summarized in TABLE 9.

Table 9. At-grade railroad crossing design criteria

Criteria	Value
At-grade crossing locations	• On straight/tangent track • ≥ 100 feet from the end of a horizontal or vertical curve, turnout, or signal control point • ≥ 300 feet from the end of a railroad bridge • ≥ 100 feet from where trains are regularly stopped
At-grade crossing angle	90°, but no less than 75°
At-grade crossing slope	Match the cross slope of the track for 5 feet either side of the centerline of the track and do not deviate more than 3 inches from this plane for 30 feet either side of the centerline of the track

6. B. Elevated railroad crossing

When feasible and cost effective, the ADOT&PF and ARRC prefer grade separated crossings, such as elevated railroad crossings or below-grade/tunnel crossings. Elevated or overpass crossings, along with below-grade crossings, remove the potential conflict between trains and trail users by having the trail user cross the railroad track at a different elevation than the railroad track.

The recently constructed Ship Creek Trail overpass crossing of the railroad tracks (east of the project area), using circular approach to maintain ADA grades.

An elevated crossing for this project would consist of a pedestrian bridge over the railroad track(s). Vertical grades to reach the required elevation would have to meet ADA requirements (see SECTION 4, DESIGN CRITERIA). The recently constructed pedestrian trail overpass crossing of Ship Creek Trail and the railroad tracks west of Post Road is an example of an elevated pedestrian crossing and shows the length of trail required to achieve elevated crossing clearances.

ARRC prefers elevated crossing rather than under pass/tunnel crossings due to the weight of the trains and the limited flexibility in railroad geometry for railroad bridges. Additional ARRC requirements for elevated/overpass railroad crossing are summarized in TABLE 10.

Table 10. Overpass railroad crossing design criteria

Criteria	Value	Notes
Overpass snow considerations	"closed railing" design at least 5 feet in height without openings, to prevent snow falling on track	Snowplowing snow over the edge of the overpass is prohibited.
Overpass pedestrian considerations	Fencing or railings at least 8 feet high if curved inward or 10 feet high if straight fence	Fence shall extend a minimum of 25 feet beyond the existing and future clear zone

6. C. Below grade crossing:

Below grade, or underpass crossings also remove the potential conflict between trains and trial users by having the trail user cross the railroad track at a different elevation than the railroad track. Below grade crossings can be accomplished through either a tunnel under the tracks or having the tracks go over the road/trail on a bridge. For this project, the underpass crossing would consist of a pedestrian tunnel underground below the railroad track(s). Vertical grades to reach the required below ground elevation would have to meet ADA requirements (see SECTION 4. DESIGN CRITERIA). Additional ARRC requirements for underpass railroad crossing are summarized in TABLE 11.

Table 11. Underpass railroad crossing design criteria

Criteria	Value	Notes
Underpass crossing locations	• On straight/tangent track • ≥ 100 feet from the end of a horizontal or vertical curve • ≥ 300 feet from the end of a railroad bridge, turnout, or at-grade crossing	Horizontal distance to a curve can be calculated as the distance travelled by a train at design speed in two seconds, but no less than 100 feet.

7. COASTAL ENGINEERING ANALYSIS

The entire project area is either directly within or immediately adjacent to the Anchorage Coastal Zone Management boundary. The marine environment (waters classified as Section 10 waters under the Clean Water Act) is a biophysical zone that includes near-shore waters and wetlands inland to the mean high water line. FIGURE 4 shows the boundaries of the marine waters, wetlands, and the 100-year flood plain.

Shoreline modifications, such as fill, can impact aquatic or marine habitats, alter sedimentation transportation routes, induce erosion or accretion, and alter tidal circulation patterns. Removal of shoreline vegetation can result in temporarily increased turbidity, adversely affecting the overall marine environment by reducing light penetration that is important to photosynthesis. Re-vegetation of a disturbed area, using native species, will help mitigate adverse impacts to coastal work.

Shoreline stabilization and armoring, while important to help prevent excessive erosion, can result in the loss of shallow water habitat. Additionally, the cumulative effects of multiple projects, not just the current project, need to be considered when evaluating the impacts to marine and aquatic habitats.

Work within the coastal zone will require a permit from the US Army Corps of Engineers (USACE) for alterations to navigable waters of the US (Section 10 waters). The ACMP requires a Consistency Review by the State of Alaska for land and water uses that require a federal or state permit. For land and water uses that require only a local permit, the MOA Planning Department will conduct the Consistency Review.

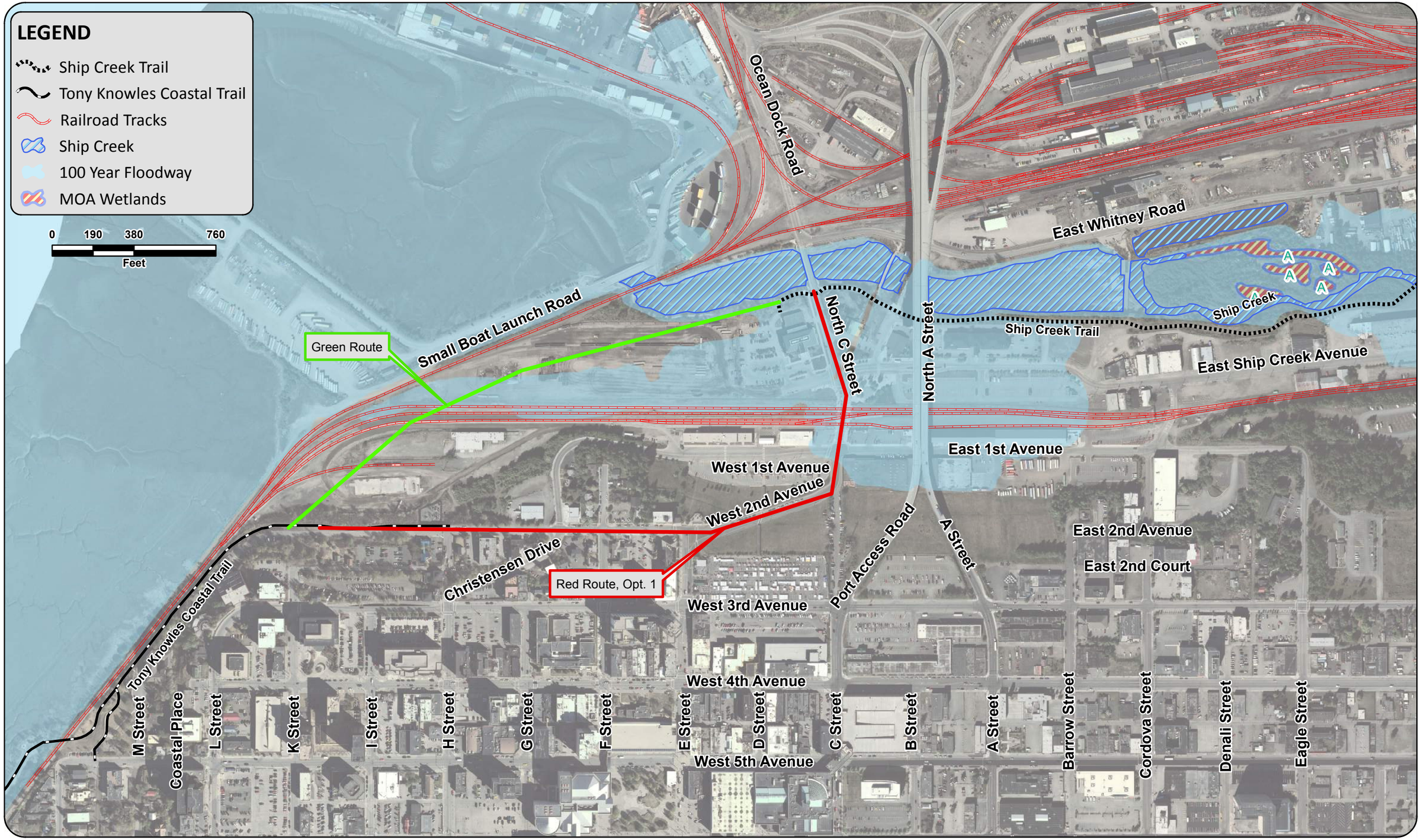

Figure 4 - Wetlands, Marine, and Flood Zone Boundaries

Aerial Image: MOA 2015

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8. RECREATIONAL CONSIDERATIONS

Anchorage is the only major US city on a large body of water without an accessible waterfront. There is currently no pedestrian access to the Cook Inlet/Knik Arm waterfront. Vehicles can use Small Boat Launch Road to access the small boat launch but this is not an appealing route for pedestrians as it traverses through a shipping container storage area. While the Coastal Trail provides views to the inlet and mountains, it does not provide access to the water for fishing or other recreation. The developments in the downtown and Ship Creek areas abut mud flats, which are dangerous for pedestrians. The Coastal Trail and Ship Creek Trail are disconnected from each other and downtown. Connecting these two trails would provide a continuous link to/from downtown Anchorage, Ship Creek, recreational opportunities, fishing, and general wildlife viewing.

The *Ship Creek Framework Plan* (October 2014) and its predecessor the *1991 Ship Creek Waterfront and Land Use Plan* introduced long-term visions for development of an active, pedestrian-oriented waterfront in the Ship Creek and surrounding Downtown area. Building on the goal identified in the *Anchorage Bowl – Park, Natural Resource and Recreation Facility Plan*, the *Ship Creek Framework Plan* identifies the Ship Creek waterway and its adjacent greenbelt as a primary natural resource within the Anchorage Bowl and recommends securing public waterfront access, enhancing water quality, and restoring streams and habitat diversity. It recommends not only improving access to Cook Inlet waterfront but also connecting the trails to each other, downtown, and recreational opportunities.

The importance of public access in Anchorage to coastal resources for recreation, quality of life, and tourism economy is also recognized in the *Anchorage Coastal Management Plan* (ACMP). Public access to coastal waterfront and resources has been an essential goal of the *ACMP* since the 1970s. To support this goal, a "Recreation Use Designation" has already been established for the Coastal Trail from downtown to Kincaid Park. Additionally, an area may be designated as a "Recreational Use" area if 1) the area receives significant use by persons engaging in recreational pursuits, or 2) the area has potential for recreational use because of physical, biological, or cultural features. Based on this, the proposed connection from the Coastal Trail to the Ship Creek Trail could be eligible for Designated Recreational Use. This designation allows for structures, transportation features, and other recreation related improvements to be located within the Coastal Management Plan area, provided they still meet Ordinary High Water setbacks and relevant municipal regulations.

The Ship Creek Trail Signage Plan, the pilot project of the *Anchorage Trails Initiative – Signage and Wayfinding Plan (2016)* also exemplifies the importance the community places on connecting residents to trails and recreational opportunities.

9. WILDLIFE

The *ACMP* identifies the following fish and wildlife habitat areas within the project area:

- Anadromous Fish: all of Cook Inlet is designated as Essential Fish Habitat for both juvenile and adult life-stages of Pacific Cod, walleye Pollock, and sculpins. All streams, lakes, and wetlands and other water bodies that support anadromous fish species are considered freshwater Essential Fish Habitat.
- Marine fisheries and mammals: Upper Cook Inlet includes marine fisheries of foraging and ground-fish species. Mammals in the project vicinity include beluga whales in Cook Inlet, including near the mouth of Ship Creek where they are seen from July to October. Beluga whales are listed as Endangered on the Threatened and Endangered Species List and are subject to National Marine Fisheries Service (NMFS) jurisdiction, including noise level and habitat loss requirements.
- Birds of prey (raptors): raptor habitat includes nesting sites, roosting sites, and migratory habitat. Bald Eagles and Diurnal Hawks are included in the raptor category. Raptor nesting or migrating patterns can limit construction clearing work.
- Waterfowl: waterfowl habitats are those areas that provide regular waterfowl migration, molting, winter habitats, and nesting habitats. Critical winter habitats have been identified in lower Ship Creek.
- Shorebirds: Upper Cook Inlet is a major migration corridor for shorebirds. During the spring, summer, and fall, shorebirds, gulls, and waterfowl use the mudflats of Ship Creek. The area of coastal wetlands and mudflats south of the Port of Anchorage, from Ship Creek to Potter Marsh, has been nominated as an Important Bird Area by the National Audubon Society.

10. HISTORIC PROPERTIES

Buildings and sites that are listed in the National Register of Historic Places (NRHP) are eligible for federal and state grant programs for planning and rehabilitation, preservation easements to protect the historic resource, and International Building Code fire and life safety code alternatives. When a federally funded or permitted activity is proposed that might negatively impact a listed property, there is a process to try and prevent negative impacts to significant properties. The owner is included in any process if a listed property is to be adversely impacted by a public project. Current buildings and sites in the project area that are listed in the NRHP and shown on FIGURE 5 are:

1. Anchorage Depot (Alaska Railroad Depot) (411 W. 1st Avenue)
2. AEC Cottage No. 23 (618 Christensen Dr.)
3. AEC Cottage No. 25 (645 W. 3rd Avenue)
4. Leopold David House (605 W. 2nd Avenue)
5. Oscar Anderson House (911 W. 4th Avenue)

Although the Ship Creek area is not technically a neighborhood because it does not have its own community council, it is included in the *Historic Preservation Plan (HPP) for Anchorage's Four Original Neighborhood*s (February 2013) because it is a unique subset of the original neighborhoods and has its own adopted master plan. Through the *HPP* Public Outreach Process, the following buildings, sites, and stores (listed in alphabetical order) were identified as the most precious resources in Ship Creek. The *HPP* does not identify the address of these sites and thus they are not included on FIGURE 5.

1. Freight Shed
2. Alaska Engineering Commission (AEC) Power Plant* (Anchorage Railroad Yard)
3. AEC Cold Storage Facility (Ship Creek Avenue, no longer railroad-owned)
4. Warehouse Three*
5. Engine Repair Shop*

*Building is functionally obsolete and/or unable to meet ARRC's operational needs and therefore may not be feasible to preserve.

11. GEOTECHNICAL AND CONTAMINATED SITES INVESTIGATION

11. A. Contaminated Sites

A review of the Alaska Department of Environmental Conservation (ADEC) contaminated sites and leaking underground storage tank (LUST) database on August 10, 2016 by Shannon & Wilson revealed 8 contaminated sites and 6 LUST sites within or adjacent to the project area. FIGURE 5 shows the locations of the contaminated and LUST sites. A summary of the information included with the ADEC database is included in the Preliminary Geotechnical Study in APPENDIX D.

If construction is planned within an active contaminated site, on-site soil and groundwater sampling should be further investigated. Closed sites may include institutional controls that require additional coordination and planning before soil or groundwater can be disturbed. It should be noted that groundwater contamination can migrate several hundred feet from a contaminated or LUST site.

The Ship Creek area is industrial in nature and has been for years and thus contaminated soils and groundwater may be present, even in non-documented contaminated or Leaking Underground Storage Tank (LUST) sites. Depending on the selected alignment, it may be prudent to conduct Phase I and/or II Environmental Site Assessments (ESA) to evaluate the potential for soil and groundwater contamination along the proposed alignment prior to final design.

Industrial area at Ship Creek Drive and Cordova Street

Small Boar Launch Road at Ocean Dock Road

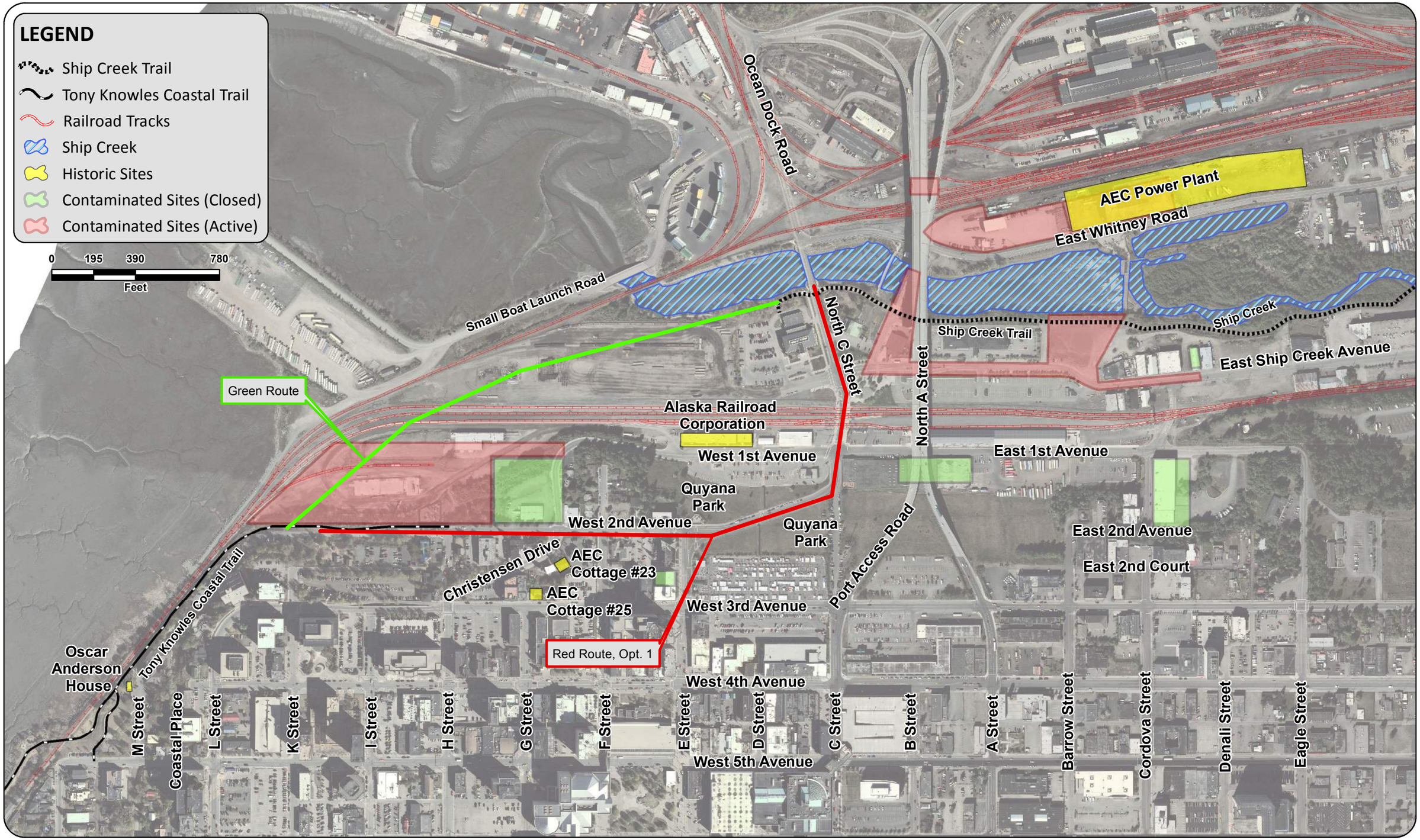

Figure 5 - Contaminated Sites and Historic Sites

Aerial Image: MOA 2015

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11. B. Existing Geotechnical Conditions

A Preliminary Geotechnical Study was conducted by Shannon & Wilson in August 2016 and is included in APPENDIX D. The Ship Creek valley, within the project area, is an approximately 0.5 mile wide creek valley bordered by steep bluffs on both the north and south sides. The bluffs rise approximately 60 to 80 feet above the valley floor. The 4th Avenue Bluff, along with the L Street Bluff, experienced outward movement with horizontal displacements of 14 to 19 feet during the magnitude 9.2 "Good Friday" earthquake of 1964.

The project area is largely located within Zone 4: High Ground Failure Susceptibility with portions of the southern edge of the project area located in Zone 5: Very High Ground Failure Susceptibility (see FIGURE 6). Development restrictions were established for the buttress area but these restrictions sunset in 2005 and are no long applicable. The Geotechnical Advisory Commission (GAC), which advises the Assembly, Mayor, Planning & Zoning Commission, Building Safety, MOA departments, and the professional design community on issues relating to natural hazards and risk mitigation, may consider reinstating these development restrictions but this would require approval from the Assembly.

The seismically sensitive bluff between E St. and Barrow St., looking west.

The International Building Code (IBC) and its local amendments reference the mapped seismic ground failure zones and require various levels of site-specific geotechnical analysis to be completed as part of the building permit process. The return interval used for a major seismic event is dictated by AASHTO and local amendments to the IBC. In general, a "large seismic event" has a return interval of approximately 1,000 to 2,000 years and is normally associated with regional subduction zone events. A large subduction zone event similar to the 1964 Earthquake will likely be needed to re-mobilize old failure zones or initiate new failures. Failure along the bluffs will depend on magnitude/duration and peak ground acceleration of the seismic event. Based on experience, it is estimated that risk to ground failure in the highest susceptible locations would increase significantly for earthquakes of magnitude 8.0 to 8.5 or higher with peak ground accelerations of greater than 0.3g to 0.4g.

The IBC addresses the effects of earth shaking on structures but not land sliding, spreading, or liquefaction beneath a structure. Therefore, Anchorage's local amendments to Building Codes require as part of the building permit review process that proposed buildings in seismic hazard zones 4 and 5 undergo a geotechnical analysis and, if required, a review by the GAC. The applicant must demonstrate that the proposed building would remain intact long enough for the occupants to get out safely. Areas within the Ship Creek Plan study area have seen development proposals which did not go forward because of the geotechnical findings and requirements dissuaded the developers. No habitable buildings are proposed with this project but a seismic review would still be required.

A review of existing subsurface explorations and data in the project area found that the soils in the project area, in general, consist of the following layers, in descending order from ground surface:

1. In the Ship Creek Valley bottom area:
    a. Granular fill, typically 4 to 15 feet deep
    b. Estuarine (tidal), fine-grained silt and clay deposits, extending between 18 to 28 feet below ground surface (bgs)
    c. Ship Creek Alluvium, a sand and gravel layer ranging from 5 to 15 feet thick
    d. Thick zone of clays and silts of the Bootlegger Cove Formation (BCF) to depths of 175 to 185 feet below ground surface
    e. Glacially deposited sand and gravel (basal Knik sand formation)
2. In the upslope, bluff areas, and south
    a. Granular fill, typically 4 to 15 feet deep
    b. Glaciofluvial deposits of relatively compact sand and gravel
    c. Thick zone of clays and silts of the BCF to depths of 175 to 185 feet below ground surface
    d. Glacially deposited sand and gravel

Sand lenses were encountered in the estuarine layer and the BCF zone. Liquefaction of a sand seam at elevation 48 feet occurred during the 1964 earthquake, possibly contributing to the loss of strength that precipitated the 4th Avenue slide.

Clay sensitivity is estimated by calculating the ratio of undisturbed and remolded strengths. Sensitivity values less than 4 generally indicate low sensitivity while values greater than 8 indicate high sensitivity. The values reviewed for the project area range from less than 1 to about 5, with occasional higher values for discrete locations. Soft, sensitive zones within the BCF have been encountered between 20 to 50 feet elevation. The failure surface of the 4th Avenue slide corresponded to the upper surface of this soft, sensitive clay layer.

Deeper borings conducted for the A/C Street Couplet Overpass encountered a thick zone of glacially deposited sand and gravel below the BCF zone at depths of 185 bgs. But other borings that also extended to below 185 bgs did not penetrate the bottom of the clay layer, indicating an undulating interface between the BCF and the underlying sand and gravel. For most cases, the underlying glacially deposited sand and gravel is well suited as a bearing stratum for heavily loaded pile foundations.

In the project area, groundwater was encountered at depths between 3 feet bgs to 15 feet bgs in the valley bottom and between 13 and 25 feet bgs in the upslope areas. In the valley bottom, the groundwater levels are relatively close to the surface elevation of the mudflats (i.e. the average tide conditions) but the water levels in Ship Creek are tidally influenced within the project area and may fluctuate by several feet seasonally. In the upslope areas, water encountered in the generally impermeable clay zone is most generally a perched water lens in a granular material or sand seam.

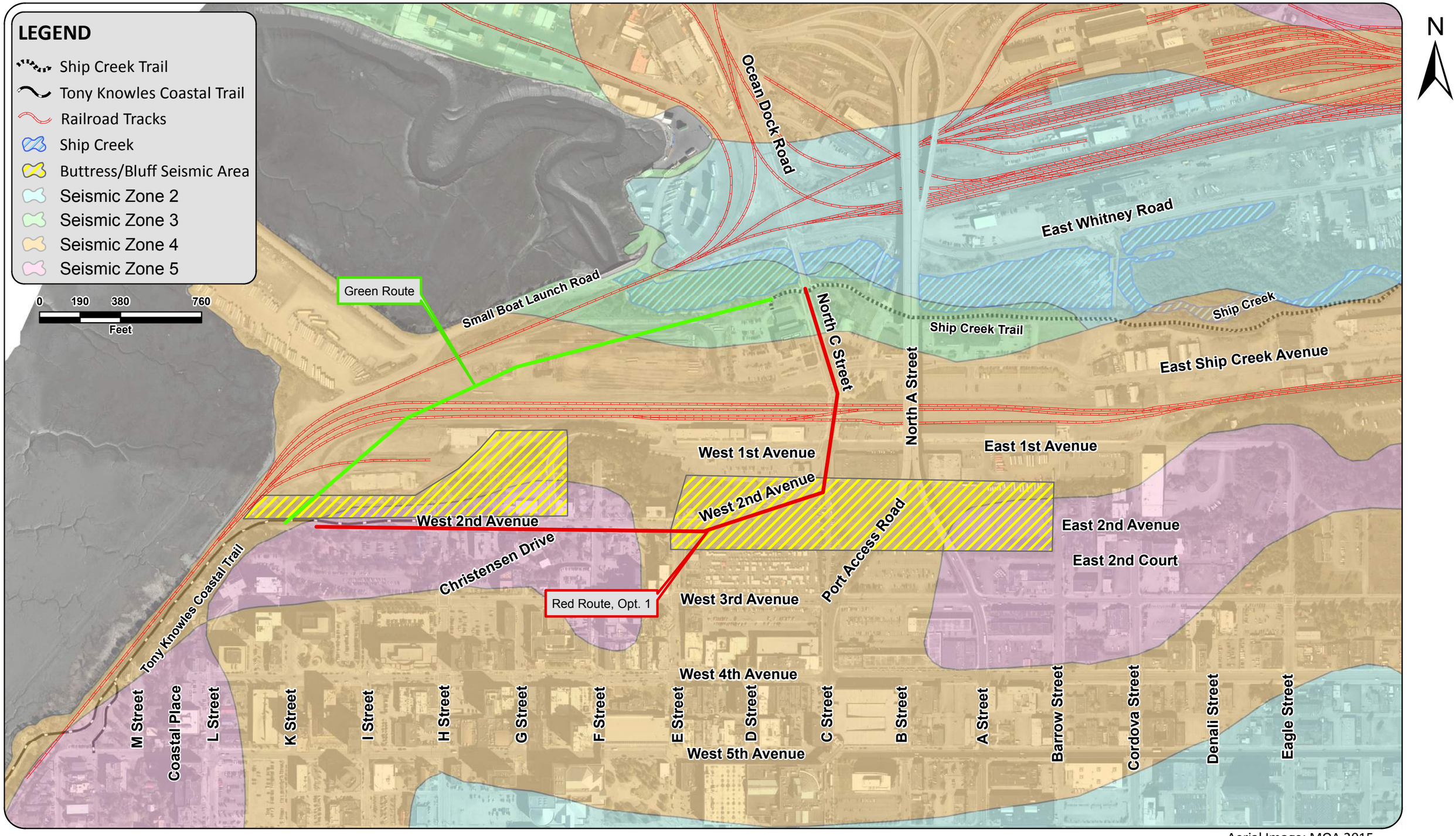

Figure 6 - Seismic Susceptibility

Aerial Image: MOA 2015

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11. C. Structural and Geotechnical Recommendations

Preliminary recommendations based on the review of historic geotechnical data are included in this report but additional, site specific explorations will be required to further refine the geotechnical recommendations for the proposed alignment.

Preliminary findings indicate the existing soil conditions of the project area will generally be adequate to support pavements, slabs, and other structures with the relatively light loads anticipated with this project. A typical structural section for a trail includes 2 inches of AC pavement over approximately 18 inches of Type II/IIA classified fill. Geotextile fabric should be included when constructed over fine-grained or poorly draining soils.

If the recommended alignment includes a pedestrian bridge, it is anticipated that piles or shallow foundations would be used to support the crossing structure. The fine-grained estuarine deposits and BCF are anticipated to be soft with low strength capability in the upper 90 feet of the soil column. Depending on the specific soil conditions and design loads, bridge piles may need to extend through the estuarine and alluvial deposits and into the BCF to provide adequate strength and resistance. Shallow foundations may be susceptible to adverse settlements due to consolidation of the estuarine and alluvial soils.

If the recommended alignment is constructed over undeveloped lands located at the existing edge of the tidal flats (i.e. the west end of the project limits), new embankments would need to be constructed. Design of these embankments need to consider both the potential for consolidation settlement as well as construction over soft ground. Depending on the size of the embankment, settlement of about 1 to 2 feet over several years' time could be expected. Additionally, the seaward side of the embankment would require armoring to protect against erosion and extreme tide events.

Development on or near the buttress areas or marginally stable slopes will be subject to the established construction restrictions and geotechnical analysis requirements of the Local Amendments to the IBC as administered by the MOA Building Safety Division. Path and trail improvements, which are non-habitat structures and designed with minimal impacts to slopes, would likely be approved without rigorous analysis but new structures, including retaining walls which are designed to retain soil, will require a higher degree of analysis.

12. UTILITY IMPACTS

Existing utilities within the project area are summarized below; SECTION 13 discusses the existing drainage in more detail. FIGURE 7 shows the location of the existing utilities. The summaries below are a preliminary analysis of the existing utilities and further investigation into possible utility conflicts will need to be conducted for the recommended alignment.

12. A. Water

The project area is served by public, piped water systems owned and operated by Anchorage Water and Wastewater Utility (AWWU). The water mains in the project area range in size from 8 inches to 12 inches in diameter and are made of ductile iron, cast iron, or HDPE, except for the water main on F Street south of 2nd Avenue, which is 6-inch asbestos concrete. At the intersection of 2nd Avenue and E Street, the water main was recently upgraded to a 10-inch HDPE pipe and was constructed with horizontal-directional drilling. At K Street extended and G Street extended alignments, the water mains cross underneath the ARRC tracks at rail yard; at these locations, the water main is enclosed in 24-inch steel casings. Depth of bury for the water mains is generally 8 to 12 feet bgs.

Water services in the project area range in size from 0.75 inches to 8 inches in diameter and are made of copper or ductile iron. Hydrants, valves, key boxes, and other water appurtenances are located throughout the project area.

12. B. Sewer

The project area is served by public, piped sewer systems owned and operated by AWWU. The gravity sewer mains in the project area range in size from 8 inches to 16 inches in diameter and are made of vitrified clay (VC), wood stave, asbestos concrete (AC), concrete, ductile iron (DI), cast iron (CI) or cured in place pipe (CIPP) liner in vitrified concrete. Larger, trunk and interceptor lines are also present in the project area and are discussed in detail below.

A large sewer interceptor line runs along the "outboard" (ocean) side of the railroad tracks along Knik Arm. At the southern end of the project (approximately 5th Avenue alignment extended), the sewer interceptor is made of DI but then it changes to reinforced concrete (RC) and continues as reinforced concrete north towards the Port of Anchorage. Anode beds were constructed adjacent to this interceptor line in Knik Arm to provide cathodic protection and control corrosion. Multiple sewer mains, ranging in size from 12 to 16 inches in diameter, and a 30-inch diameter trunk line connect directly to the interceptor line. In 2002, the interceptor crossing of Ship Creek (at the railroad bridge) was upgraded with a pair of adjacent 18-inch and 24-inch HDPE pipes that run underneath the stream bed, secured with anchors.

A 30-inch DI sewer main trunk line travels along the north side of the railroad tracks in the rail yard, along the Ship Creek Avenue alignment extended. This trunk line connects to the interceptor line at the western edge of the rail yard. The trunk line reduces in size to 24 inches at approximately the G Street alignment extended and then reduces again to 20 inches at Barrow Street alignment extended. When this sewer main was constructed, a buried tank, existing water well, and existing septic system were abandoned near the northwest side of the ARRC depot building. The 16-inch DI sewer main which connects to this trunk line at B Street alignment extended was constructed using boring methods.

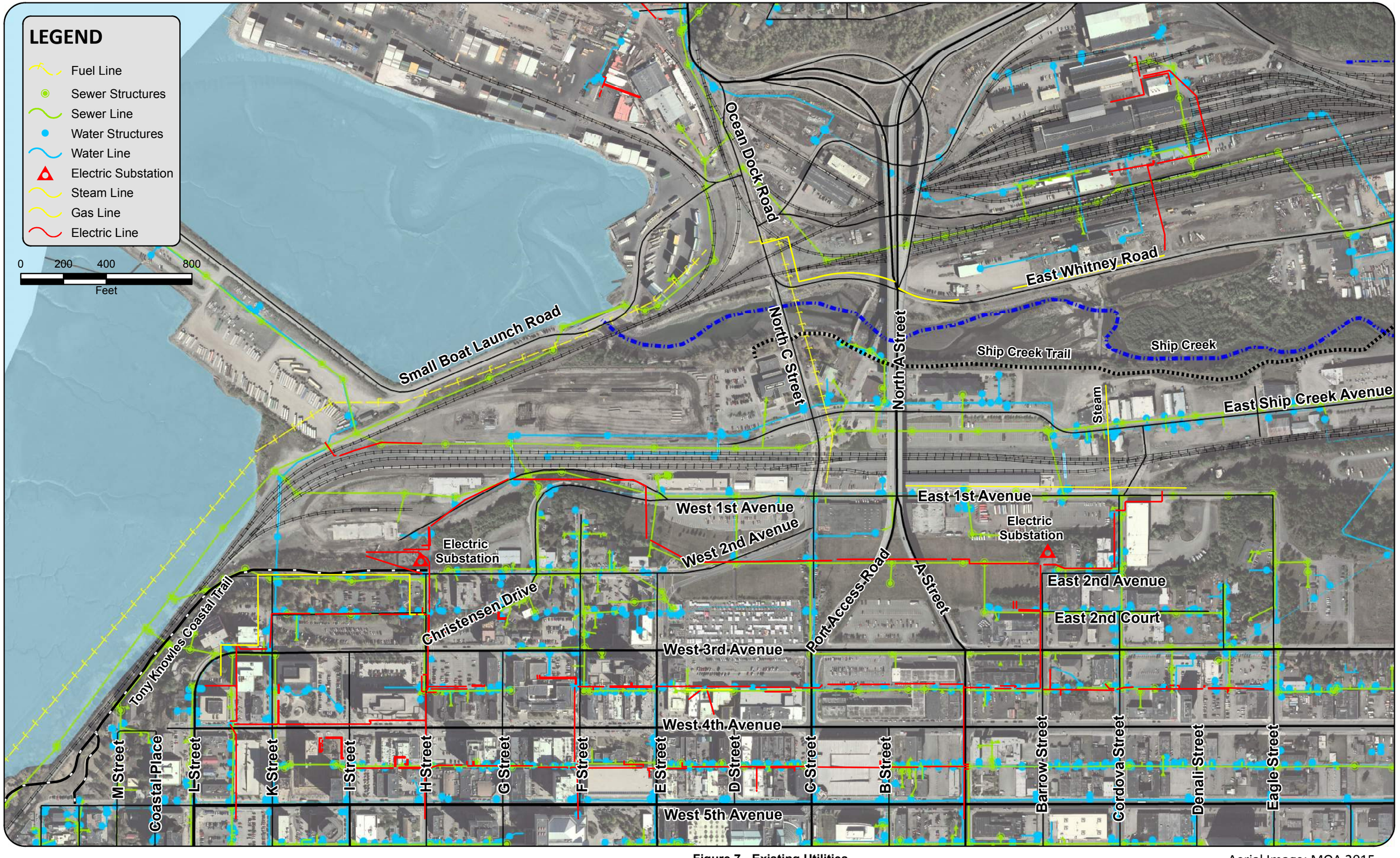

Figure 7 - Existing Utilities

Aerial Image: MOA 2015

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For the sewer mains, the depth of bury is generally 7 to 12 feet bgs, except for the sewer main along 1st Avenue east of C Street, which is generally approximately 5 feet bgs. The sewer mains that connect to this shallow main along 1st Avenue are also generally 5 to 6 feet bgs. For the interceptor line, the depth of bury in the project area is generally 4 to 7 feet bgs. For the trunk line, the depth of bury is generally 6 to 14 feet bgs, with the shallower sewer located east of C Street.

Sewer services in the project area range in size from 4 inches to 6 inches in diameter and are made of CI, AC, or concrete. Manholes, cleanouts, and other sewer appurtenances are located throughout the project area.

12. C. Storm Drain

MOA owns and operates the existing piped storm drain systems in the project area. At the west end of the project, an 18- to 24-inch diameter piped system that runs along K Street and 2nd Avenue outfalls to Knik Arm just north of 2nd Avenue (extended). A 30-inch system that drains the rail yard crosses underneath the railroad tracks and outfalls to Knik Arm on the north side of Small Boat Launch Road. Four additional systems outfall directly to Ship Creek:

- 24- to 36-inch system along E Street, 1st Avenue, and the ARRC depot
- 18- to 36-inch system along 2nd Avenue and C Street/North C Street
- 10- to 24- inch system underneath the A/C Street overpass couplet and B Street ROW extended
- 18- to 24- inch system along Ship Creek Avenue and East 1st Avenue

Depth of bury for the storm drain systems is generally at least 5 feet bgs.

Additionally, local culverts that drain low areas are also located within the project area. Two 30-inch CMP culverts drain the swale located between Small Boat Launch Road and the railroad tracks. These culverts outfall directly to Knik Arm. Three 18-inch CMP culverts drain low areas located within the rail yard and areas north of the ARRC headquarters building.

12. D. Fuel

Shell Oil Products owns and operates petroleum fuel lines within the project area. A 10-inch steel petroleum fuel line runs parallel to the interceptor sewer line from the beginning of the project (southwest corner) and continues northward towards the Port of Anchorage, parallel to the sewer interceptor line. Additionally, a 6-inch petroleum line runs along the east side of North C Street.

12. E. Gas

Enstar owns and operates natural gas facilities within the project area. Natural gas mains in the project area range in size from 1-inch to 4-inches in diameter and are made of plastic or steel. Gas services in the project area range in size from 5/8 inches to 1-1/4 inches in diameter and are made of plastic, steel, copper, or extruded steel tubing with plastic sheath. There are no pressurized transmission gas mains within the project area.

12. F. Electric

Municipal Light and Power (ML&P) owns and operates overhead and underground electric lines and appurtenances in the project area. A substation is located at the northwest corner of 2nd Avenue and H Street alignment extended. Overhead and underground 35 kV lines and underground 12 kV and 4 kV lines exit this substation towards the north, south, and east. Another substation is located at the northeast corner of 2nd Avenue and Barrow Street. An overhead 35 kV line and underground and

overhead 4 kV lines exit this substation. An underground 35 kV lines runs from the west substation northeast towards 1st Avenue, then continues along the 1st Avenue until it turns north at the E Street alignment extended and then travels east towards the east substation, then continues east towards Cordova Street where it turns north towards 1st Avenue. At 1st Avenue, it becomes an overhead 35 kV line and continues east along 1st Avenue.

Overhead and underground 4 kV and 12 kV lines are located throughout the project area. Electrical structures, including transformers, concrete vaults, junction boxes, pedestals, poles, guy wires, and lights are located throughout the project area.

12. G. Cable and Fiber Optic

Alaska Communication Systems (ACS) owns and operates overhead and underground cable, communication, and fiber optic lines within the project area. A 48-count fiber optic line runs along Knik Arm, parallel to and on the "inboard" (land) side of the railroad tracks. This 48-count line turns east and parallels the railroad tracks. At the A/C Street overpass, a 12-count fiber optic line branches off of the 48-count line and travels north. Fiber optic, cable, and communication structures are located throughout the project area including concrete vaults, pedestals, poles, and abandoned cable lines.

12. H. Other Utilities

A steam line is located at the eastern end of the project area. This line runs along 1st Avenue and turns northward at Cordova Street. The line continues north, crossing Ship Creek Avenue. This line appears in GIS documents but its source and destination are unknown.

13. DRAINAGE REVIEW ANALYSIS

The project area is entirely located within the Ship Creek Watershed. Within this watershed, the bluff area (generally located west of E Street and south of 1st Avenue) is further defined as the Upper Ship Creek Watershed while the valley area is defined as the Lower Ship Creek Watershed (see FIGURE 8). The Upper Ship Creek Watershed generally drains west and outfalls directly to Knik Arm while the Lower Ship Creek Watershed drains north and outfalls to Ship Creek.

Cook Inlet and its supporting streams, including Ship Creek, are designated Essential Fish Habitat and culverts must be correctly installed to allow both juvenile and adult fish to move upstream and downstream.

Additionally, the project area is within or directly adjacent to the Anchorage Coastal Zone Management boundary. Portions of the project are also located within the 100-year flood plain. The majority of the project is classified in the Flood Insurance Rate Map (FIRM) as Zone A, which indicates it is within the 100-year flood plain but no base flood elevation has been determined. At the east end of the project area, at approximately Barrow Street extended, the base flood elevation has been determined at 19.3 feet and the FIRM classification becomes Zone AE (Zone A with the base flood elevation determined).

The mean high water (MHW) is defined as the average of all the high water heights and the mean tide level (MTL) is the average of the high water and low water heights. At the west end of the project, the MHW level for Ship Creek has been measured at 17.3 feet and the MTL at 11.0 feet. During high tides, the gravel trail that parallels Ship Creek at the west end of the project area is under water. If structures (such as tunnels) are constructed below the high tide level, berms and/or walls will be required to minimize flooding and erosion. Drainage sump pumps or other means to dewater the area during high tides will be required. Additional maintenance of the drainage system will be required to ensure removal of silt and other sediments in the pumps. The structure will also need to be designed to prevent uplift due to the groundwater/tide and its effect on buoyancy.

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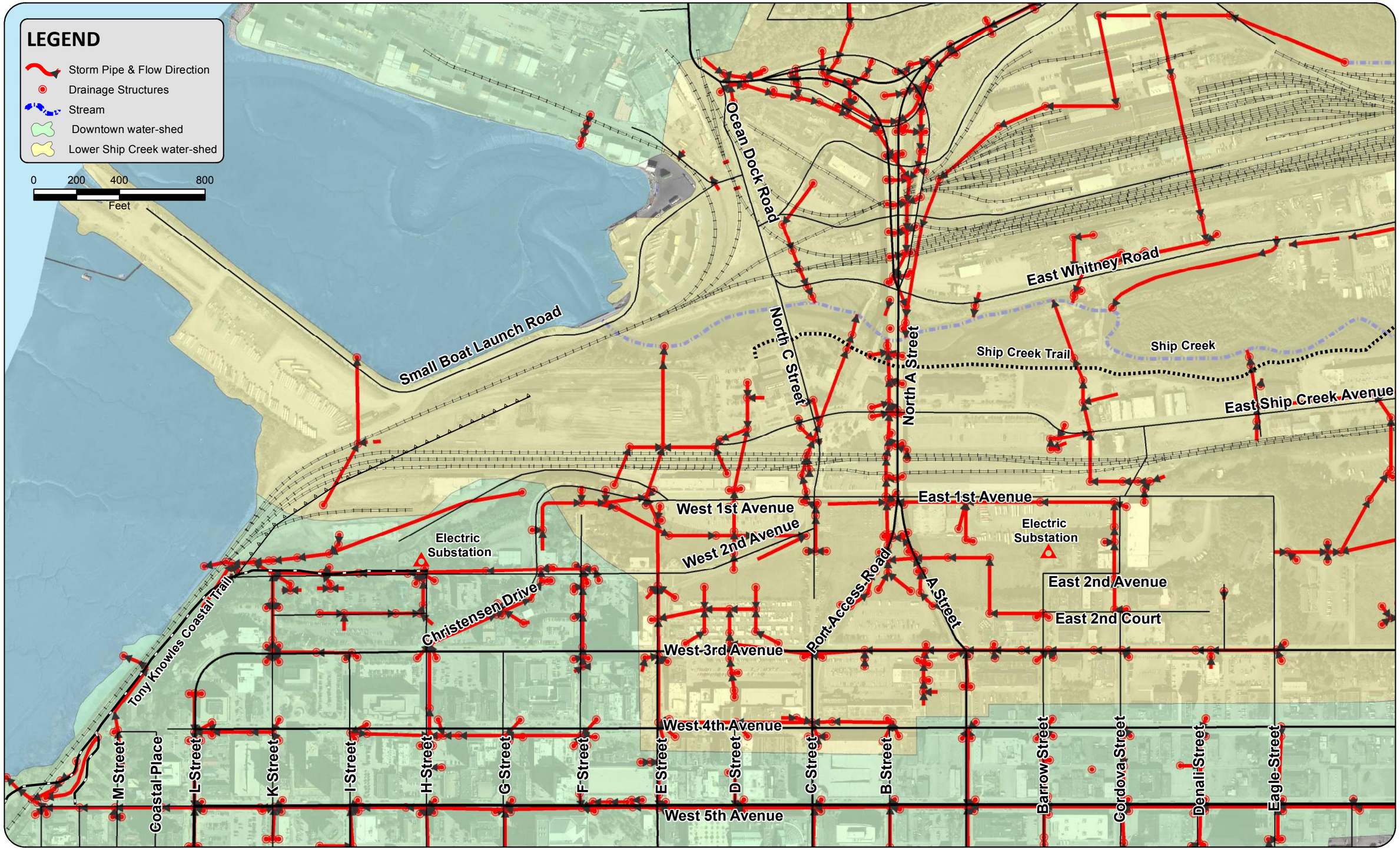

Figure 8 - Existing Drainage

Aerial Image: MOA 2015

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14. PERMITTING

The following permits are anticipated for the project.

14. A. Alaska Railroad Corporation (ARRC)

- To perform any work on ARRC property, including surveying, geotechnical explorations, and all construction work, an extensive permitting process is required.
  - Permitees are required to carry high amounts of liability insurance.
  - There is a waiver request process to reduce the required insurance amounts but it will not be granted for work within 50 feet of the tracks. Work outside of the 50 feet is still not guaranteed to obtain the waived/reduce insurance requirements.
  - Any work within 50 feet of a track requires an ARRC flagger to accompany the worker at all times. The flagger's time is paid by the organization performing the work.
    - An additional permitting process is required to obtain the required flagger.
    - The flagger is also required to be covered by the organization's insurance

14. B. ADOT&PF

- To perform work on ADOT&PF property, including surveying, geotechnical explorations, and all construction work, a review and approval of the project, as well as a permit, is required.
- Any new at-grade railroad crossing requires a Diagnostic Team review and approval, which is a joint review committee of the MOA, ADOT&PF, and the ARRC.
  - The ADOT&PF Railroad Crossing Certification Flow Chart and Checklist (see APPENDIX E) should be completed during the design to ensure the mandatory conditions of new or improved at-grade crossings are incorporated

14. C. Federal

- If the project is fully or partially fully funded with Federal money or grants, compliance with the NEPA process is required, including:
  - Environmental Assessment (EA) report.
  - Environmental Impact Statement (EIS) if the environmental impacts of the project are found to be significant in the EA.
  - An evaluation of Section 4(f) properties to document the effects, alternatives, and means of minimizing impacts. Section 4(f) of the Department of Transportation Act of 1966 was adopted to protect the natural beauty of the country side and governs the use of land from public parks, recreation areas, wildlife refuges, and historic sites.
    - Quyana Park is a Section 4(f) property.
    - The Anchorage Depot, as an historic site listed on the NRHP, is also subject to Section 4(f) requirements.

14. D. US Army Corps of Engineers (USACE)

- Portions of the project that impact areas below the high tide line (HTL) require a Section 404 permit (Clean Water Act).

- Portions that impact areas at or below the MHW require a Section 10 (Rivers and Harbors Act) permit.
- Section 10 and Section 404 permits require:
    - Determination of any resources protected under Section 106 of the National Historic Preservation Act.
    - Determination that the project will have no effect on any listed, proposed threatened, or endangered species under the Endangered Species Act of 1973.
        - A 2007 EA for the ARRC access road on the outboard (ocean) side of the existing tracks along the coast consulted with the USFWS and NMFS and found that their project would not impact the endangered beluga whale because beluga whales are unlikely to use the immediate area due to its elevation (per communication with the NMFS).

14. E. Alaska Department of Fish & Game (ADF&G)

- Because Ship Creek is an anadromous and resident fish bearing stream, impacts below the MHW will also require a Title 16 Fish Habitat Permit (AS 16.05.841-871).
    - Cook Inlet, including its supporting streams, is designated as Essential Fish Habitat (EFH) for both juvenile and adult life stages of Pacific Cod, walleye Pollock, and sculpins.
    - The project is required to demonstrate that the improvements will not adversely affect EFH.
        - The 2007 EA for the ARRC access road consulted with the NMFS and found that EFH would not be impacted.

14. F. Alaska Department of Environmental Conservation (ADEC)

- Dewatering within 1500 feet of an ADEC identified contaminated sites require an excavation dewatering permit from ADEC.

14. G. MOA

- Urban Design Commission (UDC): approval from the UDC is required. The UDC reviews adherence to comprehensive plans and Anchorage Municipal Code Title 21, Land-Use Regulations.
- Planning & Zoning Commission (PZC) approval. The PZC reviews projects on public streets (collector or higher), parks (greater than 1.5 acres), and public facilities (more than 4,000 sf).
    - Development within the Planned Community PC area of Ship Creek requires review by the Ship Creek District Review Board in addition to the PZC.
- Flood Hazard Permit
- Federal Emergency Management Agency (FEMA) may require a No Rise certificate or a Conditional Letter of Map Revision (CLOMR) / Letter of Map Revision (LOMR) should any structure(s) cause a rise in the floodplain's base flood elevation.
- Stormwater review by Watershed Management Section. The design guide for the treatment and management of storm water is currently being updated and a Draft Anchorage Stormwater Manual was completed in 2015.
- Geotechnical Advisory Commission

- Parks and Recreation Commission for review and concurrence
- Traffic Department for review and concurrence
- ACMP Consistency Review (Designated Recreation Use area)
    - 50’ setback from Ordinary High Water unless there is no practicable alternative location for the use or activity.
    - Water-related (versus water-dependent) Uses and Activities include pedestrian-oriented access or other similar uses that provide access to and/or views of the shoreline.
    - Capital improvements on publically owned property shall incorporate walkways, shelters, viewing platforms, and landscaping whenever practicable to enhance public access to coastal waters.

15. ALTERNATIVES ANALYSIS

Some of the significant design challenges associated with the Downtown Trails project are listed below.

- ARRC owns most of the property in the Ship Creek area
- Property ownership of ARRC lands and ADOT&PF land will require extensive coordination and planning
- The trail will require at least one railroad track crossing either at-grade, elevated, or below grade through a tunnel.
- Large elevation changes exist between downtown Anchorage and the Ship Creek area.
- Vehicles, busses, trains, freight trucks, pedestrians, anglers, and bicycles all utilize the Ship Creek area.
- Geotechnical constraints include the seismically sensitive buttress area between 3rd and 1st Avenues, fine grained silts and Bootlegger Cove clay to a depth of 90 feet below ground surface (bgs).
- Groundwater is typically encountered 10 feet to 20 feet bgs.
- Base flood elevation of the 100-year flood in the area is 19.3 feet elevation and MHW is 17.3 ffeet. The current railroad track at the Ship Creek bridge crossing has an elevation of approximately 22 feet.
- Permitting requirements to fill within a coastal area.
- The various needs and preferences among recreational, tourist, and commuter user groups.
- Ability to accommodate secondary benefits of a trail connection such as:
    - Provide direct access between downtown Anchorage and the Ship Creek area
    - Provide access to the Small Boat Launch
    - Provide a destination with direct water-front and coastal access
    - Reduce user conflict between pedestrians, bicyclist, anglers, and vehicles
    - Reduce ARRC track or facility incursions

The design process for selecting a preferred alternative was an iterative process involving meeting with multiple stakeholders and working groups. Full discussions of each option are included later in this section. Below is an overview of the design alternative development process.

1. *Level 1 Analysis:* Five options – Red (Opt. E), Orange (Opt. D), Yellow (Opt. C), Green (Opt. B), and Blue (Opt. A) – with many variations within each option, underwent "high-level" analyses to determine if the alignment was reasonably viable (see FIGURE 9). Stakeholder input was solicited at the 1st Stakeholder Working Group (SWG #1) meeting and at a public Open House. This resulted in the elimination of the Orange (Opt. D) and Yellow (Opt. C) options.

2. *Level 2 Analysis:* The remaining three alternatives were presented at the 2nd Stakeholder Working Group (SWG #2) meeting to solicit additional input and comments. These alternatives were also analyzed in more detail and conceptual designs were developed based on the MOA DCM design criteria for a paved pathway. The result of the Level 2 Analysis is the recommended alternative(s).

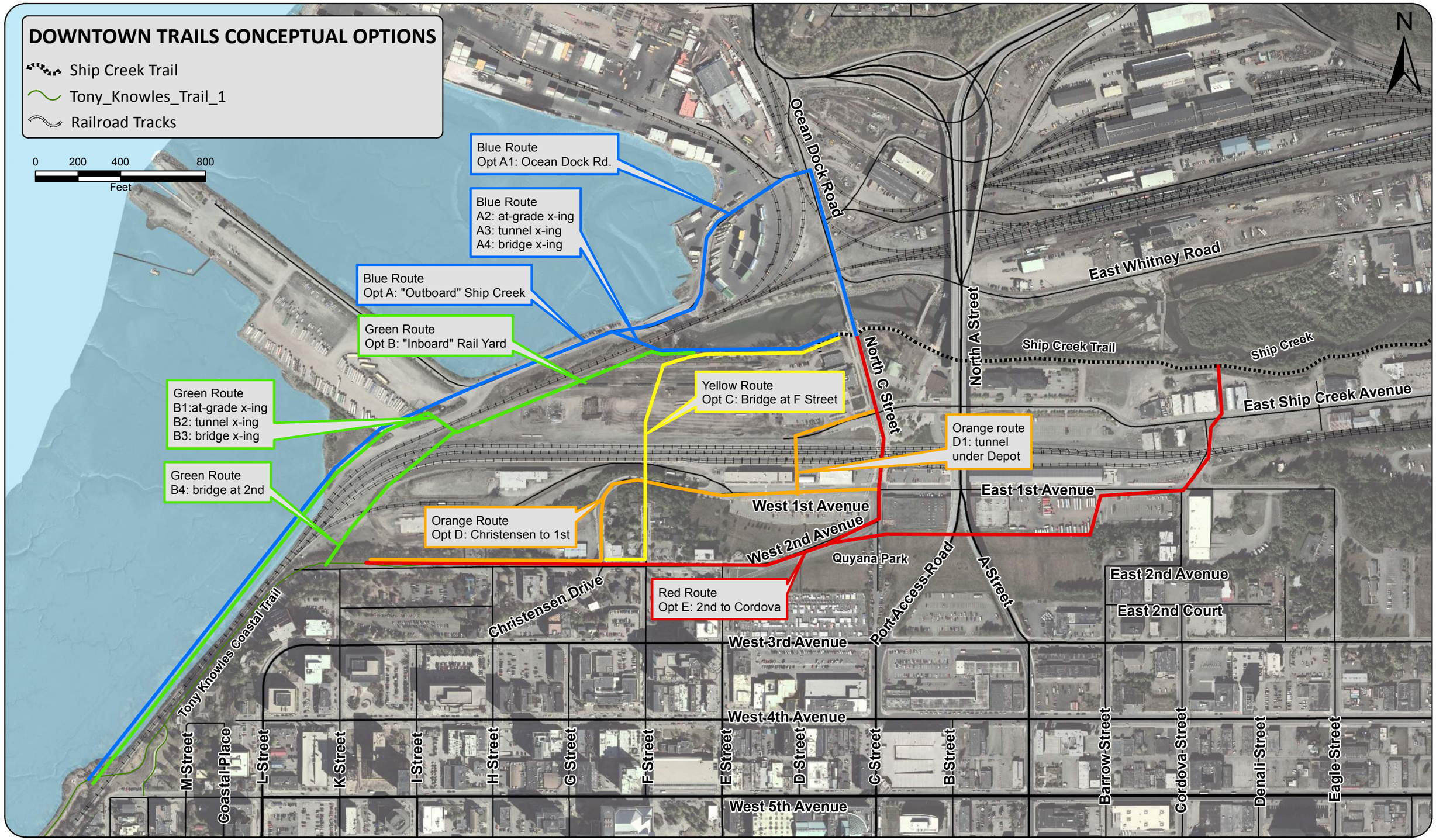

Figure 9 - Level 1 Analysis Options

Aerial Image: MOA 2015

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15. A. Level 1 Analysis

15. A. 1. Red Route (Option "E")

This route travels along 2nd Avenue beginning at the current terminus of the Coastal Trail at H Street. The route continues east past the Eisenhower Memorial at E Street and 2nd Avenue, continues east across the bluff (Quyana Park) between E Street and Cordova Street and then turns north and travels along Cordova Street until Ship Creek Avenue. Here it turns east again and then north to connect with the Ship Creek Trail.

Following input and ideas at SWG #1, the Red route was updated to include two options for the level 2 analysis. Option 1: continue along 2nd Avenue all the way down the hill to connect with North C Street at Ship Creek Trail and, Option 2: continue along the bluff east of 2nd Avenue but turn north towards 1st Avenue before Barrow Street to avoid the steep grades and poor sight distance at the intersection of 2nd Avenue and Cordova Street. (The updated Red Alternative with its two options is show in FIGURE 10.)

Steep grades of Cordova St., looking north towards 2nd Ave.

Limited sight distance at Cordova St. at 1st Avenue (looking north) due to building on southeast corner of intersection.

15. A. 2. Orange Route (Option "D")

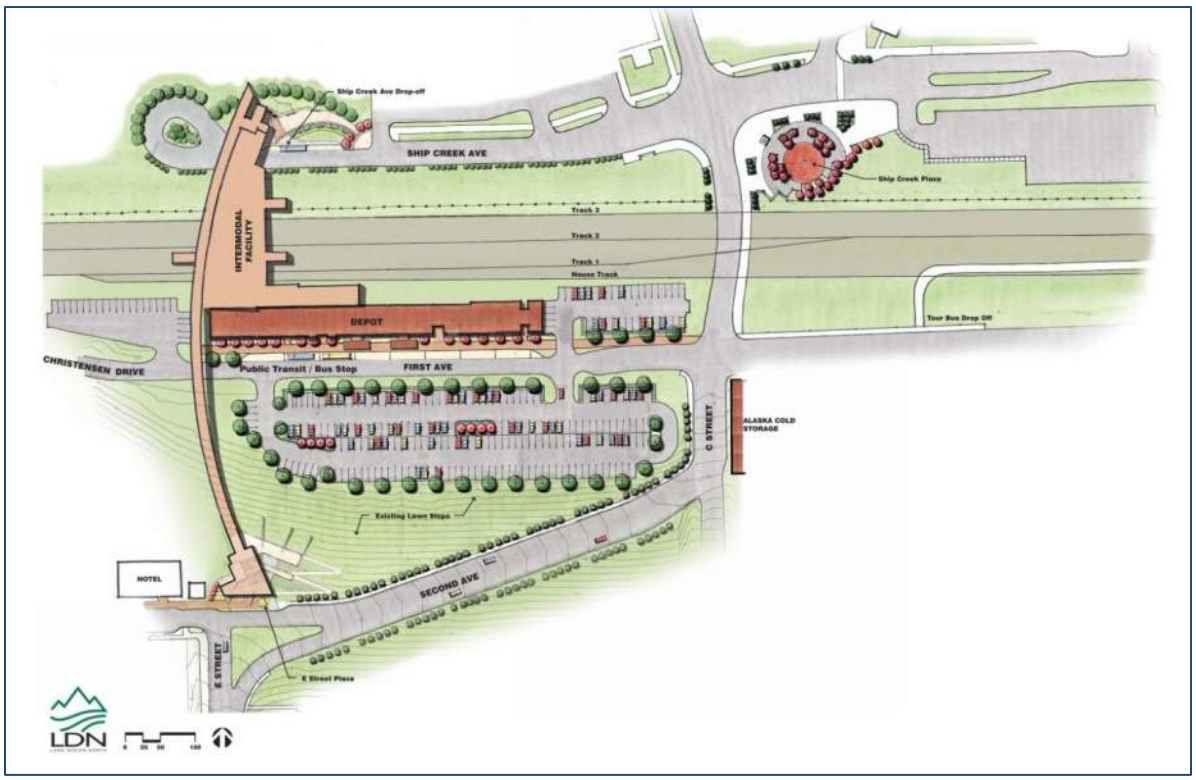
Like the Red Route, this route travels along 2nd Avenue beginning at the current terminus of the Coastal Trail at H Street. The Orange route turns north at Christensen Drive and follows Christensen Drive north and east to 1st Avenue. At C Street, the route turns north along C Street to connect with the Ship Creek Trail. A variation of the Orange route ("Orange-D1" in FIGURE 9) included a tunnel underneath the ARRC Depot.

15. A. 3. Yellow Route (Option "C")

Like the Red and Orange Routes, this route travels along 2nd Avenue beginning at the current terminus of the Coastal Trail at H Street but turns north at F Street. A pedestrian sky bridge at the north end of F Street would be constructed to connect to the Ship Creek Trail west of C

Street. Reconstruction of the Ship Creek Trail on the west side of North C Street would be required to bring the trail above the high tide level.

Although E Street offers a unique north-south connection from Delany Park Strip at 9th Avenue to 2nd Avenue and is identified in the *Downtown Comprehensive Plan* as a Primary Pedestrian Connection from Downtown Anchorage to Ship Creek, the Yellow Route proposed a sky bridge at F Street because of the ARRC's plans for an Intermodal Transportation Center, which includes a pedestrian sky bridge at E Street. As outlined in their *Alaska State Rail Plan* (November 2016), the ARRC is pursuing an Intermodal Transportation Center (ITC) in the Ship Creek Area.



Conceptual rendering of the Intermodal Transit Facility (2007)

15. A. 4. Green Route (Option "B")

The Green Route is generally the "in-board" (rail yard/land side) route and contained multiple variations. Routes "Green-B1", "Green-B2", and "Green-B3" connected to the existing Coastal Trail at Elderberry Park, before it turns inland and crosses under the railroad tracks. These routes continued as out-board trails until the Small Boat Launch and rail yard, north of the railroad tracks. Here these routes crossed the railroad tracks to then travel along the in-board side of the tracks, adjacent to the rail yard. "Green-B1" used an at-grade crossing to cross the railroad tracks, "Green-B2" used a tunnel, and "Green-B3" used a pedestrian overpass bridge.

"Green-B4" followed a different in-board route and connected with the Coastal Trail at the top of the bluff near 2nd Avenue and L/K Streets. From here, a pedestrian sky bridge travelled across the rail yard to connect with the Ship Creek Trail on the west side of C Street. Like the Yellow Route, the Ship Creek Trail west of C Street would need to be raised and reconstructed to bring the trail above high tide level.

15. A. 5. Blue Route (Option "A")

The Blue Route is generally the "out-board" (coastal side) route and also contained multiple variations. Like Green-B1 through Green-B3, routes "Blue-A2", "Blue-A3", and "Blue-A4" connected to the existing Coastal Trail at Elderberry Park before it turns inland and crosses under the railroad tracks. These routes continued as out-board trails until the Small Boat Launch where they followed Small Boat Launch Road until Ship Creek. Blue-A2 through Blue-A4 crossed the railroad tracks on the south side of Ship Creek to connect to the Ship Creek Trail using either an at-grade crossing (Blue-A2), a tunnel (Blue-A3), or a pedestrian overpass (Blue-A4). Ship Creek Trail west of C Street would need to be reconstructed to address the high tide levels. Following the public Open House and SWG #1, the at-grade crossing of the railroad tracks was moved southwest, to avoid the multi-directional freight train movements near the rail bridge over Ship Creek. This new option travels along the rail yard to connect with the Ship Creek Trail and is shown in FIGURE 10.

"Blue-A1" followed the same routes as Blue-A2 through Blue-A4 but did not cross the railroad tracks south of Ship Creek. Instead, Blue-A1 continues along Small Boat Launch Road over Ship Creek utilizing the existing roadway bridge. Blue-A1 follows Small Boat Launch Road until connecting with Ocean Dock Road where it turns south along C Street to connect with the Ship Creek Trail.

These five options (Red, Orange, Yellow, Green, and Blue) and the associated variations were presented to the SWG #1 on July 28th, 2016. Meeting reports from SWG #1 and SWG #2 and comments summary and the full comment log from the public Open House can be found in APPENDIX C. Comments from the SWG #1 indicated the following main themes in regards to the preferred alignment:

- The secondary benefits (coastal access, user experience, connection to downtown) of this trail connection are important aspects of this project.
- Consider adding an option to the Red Route that travels down 2nd Avenue to North C Street. The extra distance down the hill will help keep the hill from being excessively steep.
- At-grade railroad track crossings are not preferred but they can be accommodated with appropriate measures.
    - If crossing the railroad tracks at C Street, the at-grade crossing should be on the east side of the street.
    - At-grade crossings of railroad tracks at multi-directional trail travel locations is strongly not preferred.
- If the trail crosses over the railroad tracks, the trail separation must accommodate a "double-stack" railcar.
- Tunnels are not preferred due to safety and maintenance issues.

- There is currently significant congestion with tour busses and pedestrians at the ARRC Depot on 1st Avenue.
- The ARRC has plans for future development of the parcels west of Christensen Drive and north of 2nd Avenue.
- Tour buses park on the south side of 2nd Avenue in the summer.
- Mixing of traffic modes (pedestrian, bicycle, vehicle) is not preferred in order to avoid conflicts and associated safety concerns.
- Mixing of commercial truck traffic with pedestrians and bikes is strongly not preferred.

First Avenue and the ARRC Depot. This area becomes very congested with pedestrians, tourists, and tour busses in the summer months.

Comments from the public Open House held on October 20th indicated the following main themes in regards to the preferred alignment:

- Concerns with safety and crime associated with tunnels
- Concerns with trespass onto ARRC property and crime if trail is located between railroad tracks and rail yard
- At-grade rail crossing are acceptable with proper engineering
- Avoid routes that require steep hills
- Consider short term and long term/future options
- Keep the costs down, including construction and maintenance costs
- Preferred route is the Red Route (15 public comments) followed by the Blue (8 comments) and the Green route (5 comments)

Following the SWG#1 and the public Open House, the following routes were eliminated.

- Orange Route in its entirety was eliminated because of the steep grades along Christensen Drive and the existing congestion at the ARRC Depot. Orange-D1 (tunnel under the Depot) was eliminated because:

  1. Tunnel crossings are not preferred due to safety and maintenance concerns.

2. The 5% grade requirement to meet ADA access results in a long, switch-back style trail to cross underneath the Depot. The construction of a long trail would result in significant impacts and constraints to future development and workflow options at the ARRC Depot.

Steep grades along Christensen Dr. where it turns southeast to 1st Avenue.

Example of pedestrian tunnel underneath railroad tracks (Whittier, AK)

- Yellow Route in its entirety was eliminated because of its location adjacent to the working area around the ARRC Depot and proximity to the planned Intermodal Transportation Center (ITC). Until the Intermodal Transportation Center is further along in development, the construction of a pedestrian sky bridge would limit options and locations for the ITC.
- Blue Route – the following options were eliminated:
  1. Tunnel crossing at Ship Creek/Small Boat Launch Road (Blue-A3) because of drainage and maintenance issues with a tunnel below high tide levels.
  2. Pedestrian overpass crossing at Ship Creek/Small Boat Launch Road (Blue-A4) because the 5% grade requirements to meet ADA results in a long, switch-back or cork-screw style trail to cross over the tracks. These long access ramps result in significant impacts to the adjacent areas including sight distance issues to train movements in an active rail yard.
  3. Ocean Dock Road route (Blue-A1) because of the significant number of roadway, truck route, and railroad track crossings. These railroad tracks accommodate bi-directional freight train movements. Port expansion projects with additional ship berths would only increase the number and frequency of train and truck occurrences.
- Green Route – the following options were eliminated:
  1. Tunnel crossing at the rail yard/Small Boat Launch (Green-B2) because of drainage and maintenance issues with a tunnel below high tide levels.
  2. Pedestrian overpass crossing at the rail yard/Small Boat Launch (Green-B3) because the 5% grade requirements to meet ADA results in a long, switch-back or cork-screw style trail to cross over the tracks. These long access ramps result in significant impacts to the adjacent areas including sight distance issues to train movements in an active rail yard.

3. At-grade crossing at the rail yard/Small Boat Launch (Green-B1) was incorporated into the remaining Blue Route to provide the best location for an at-grade crossing of the railroad tracks.

Existing footpath along the south bank of Ship Creek is under water at high tide.

The following options were carried forward for the Level 2 Analysis:

- Red Route, Option 1: 2nd Avenue to C Street
- Red Route, Option 2: 2nd Avenue to Cordova Street
- Blue Route: "outboard" coastal trail with at-grade railroad track crossing
- Green Route: pedestrian sky bridge from Coastal Trail at the top of bluff at 2nd Avenue to Ship Creek Trail

15. B. Level 2 Analysis

Each alternative that was carried forward to Level 2 analysis was reviewed and analyzed in more detail including utility impacts, ROW impacts, parking impacts, road crossings, track crossings, and secondary benefits. All route options were analyzed with typical sections that meet design criteria for paved, separated/side-path multi-use trails; no on-street bicycle facilities are proposed.

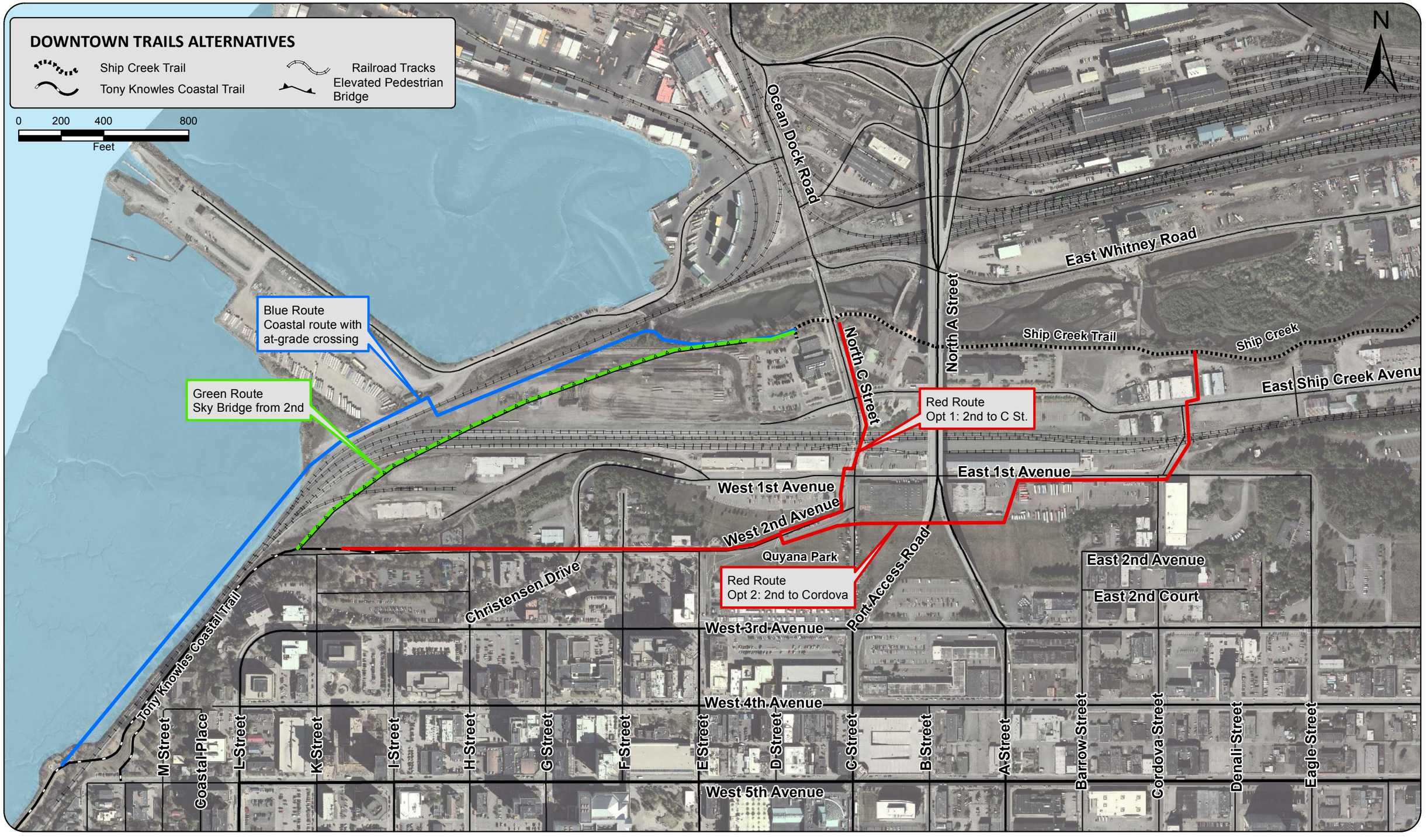


Figure 10 - Level 2 Analysis Alternatives

Aerial Image: MOA 2015

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15. B. 1. Red Route, Option 1 (2nd Avenue to C Street)

The existing conditions along the Red Route, Option 1 are summarized below in TABLE 12. All roads within the Red Route, Option 1 have existing curb and gutter along both sides. FIGURE 11 shows the layout of the Red Routes, Options 1 and 2.

Table 12. Existing Conditions along Red Route, Option 1

Roadway	ROW Width[1]	Paved Width	Existing Pedestrian Facilities	On-Street Metered Parking	Other
2nd Avenue					
H St. to Christensen Dr.	60 ft	25 ft	5 ft wide, both sides	south side only	
Christensen Dr. to E St.	60 ft	33 ft	5 ft wide, both sides	both sides	curbs bulbs at intersections
E St. to C St. (the hill)	ARRC	45 ft	5 ft wide, north side only	north side only; bus parking on south side	6.5% grade
C Street	ARRC	30 ft	17 ft wide, east side; 10 ft wide, west side	on-street parking not allowed	3.5 ft wide striped shoulders, both sides

1. If no ROW exists, the property owner is listed.

The proposed typical section for the Red Route, Option 1 along 2nd Avenue is shown in FIGURE 12. A 10 foot wide pathway is proposed to avoid excessive impacts to adjacent property driveways and slopes. While this width meets the required design criteria, a 12-foot wide pathway can be analyzed during the design to assess the impacts to adjacent properties, on-street parking, and adjacent slopes. Where feasible, the pathway would be detached from the back of curb. Parking along the north side of 2nd Avenue would be eliminated in its entirety and parking along the south side of 2nd Avenue would be eliminated west of Christensen Drive. East of Christensen Drive, metered parking along the south side of 2nd Avenue would be allowed.

Red Route, Option 1 would continue along the north side of 2nd Avenue down the hill (between E Street and C Street). This route avoids a mid-block crossing for the trail user and avoids impacts to the existing tour bus parking located on the south side of 2nd Avenue at the hill. The trail user could chose to cross C Street at the existing marked crosswalks at 1st Avenue, Ship Creek Avenue, or at Ship Creek Trail. A new pathway would be constructed along the east side of C Street between Ship Creek Avenue and Ship Creek Trail to provide pedestrian facilities along both sides of C Street.

The proposed conditions for the Red Route, Option 1 are summarized in TABLE 13.

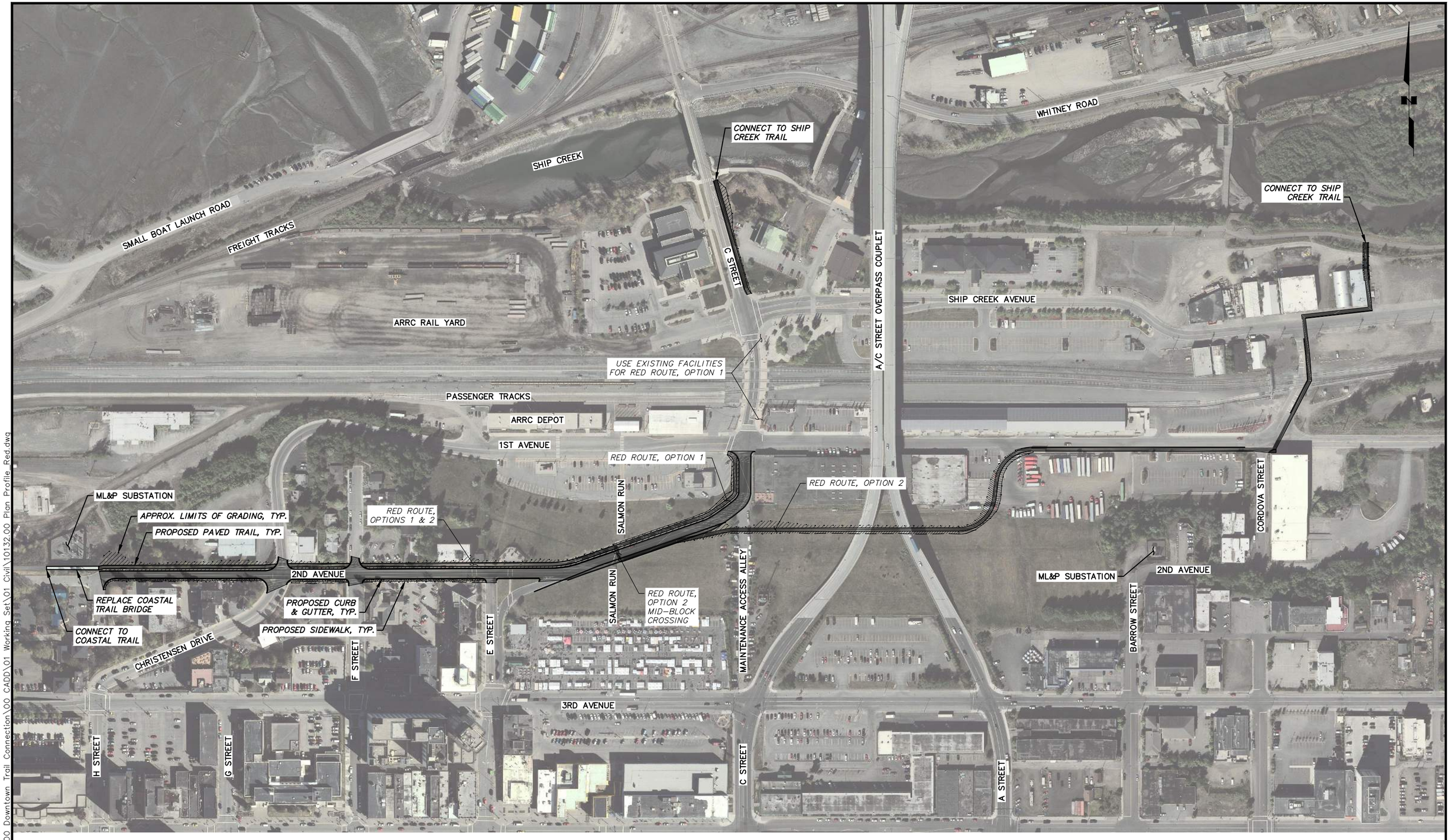
Table 13. Proposed Conditions for Red Route, Option 1

Location	Trail location	Impacts to on-street parking	Other
2nd Avenue			
H Street to Christensen	North side of roadway, detached from back of curb where feasible	Loss of 10 metered parking spaces	No on-street parking allowed
Christensen to E Street		Loss of 11 metered parking spaces and 3 car loading zone	On-street parking allowed south side only
E Street to C Street/1st Avenue	North/west side of roadway, detached from back of curb where feasible	Loss of 14 metered parking spaces	On-street bus parking on south side to remain
C Street			
1st Ave. to Ship Creek Ave.	No proposed improvements	N/A	Utilizes existing railroad track crossings
Ship Creek Ave. to Ship Creek Trail	East side, attached to back of curb	N/A	

The existing Coastal Trail, after crossing underneath the railroad tracks at Elderberry Park, travels northeast to the top of the bluff at 2nd Avenue and K St. extended. Here it turns east and continues as a separated pathway along the north side of 2nd Avenue until H Street, where it terminates.

An ML&P electrical substation is located on the northwest corner of 2nd Avenue and H Street. The substation is at approximate elevation 36 feet while the Coastal Trail at this location is at approximate elevation 58 feet. Currently, a bridge is used to cross the steep embankments and slopes associated with the substation. The bridge was constructed in 1987 and a structural analysis performed in 2014 indicates that this bridge does not meet current codes and should be replaced. The 2014 analysis ranked this bridge as the top priority for bridge replacement along the Coastal Trail.

Existing Coastal Trail bridge and ML&P substation near 2nd Ave. and H St. (looking west).



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PROJECT: 10132.00
STATUS: CONCEPT

CRW ENGINEERING GROUP, LLC
3940 ARCTIC BLVD. SUITE 300
ANCHORAGE, ALASKA 99503
PHONE: (907) 562-3252
#AECL882-AK

MUNICIPALITY OF ANCHORAGE

DOWNTOWN TRAIL CONNECTION
COASTAL TRAIL TO SHIP CREEK

RED ROUTES, OPTIONS 1 AND 2

OVERVIEW PLAN LAYOUT

DATE: MAY 2017
SCALE: 1"=125'
FIGURE: 11

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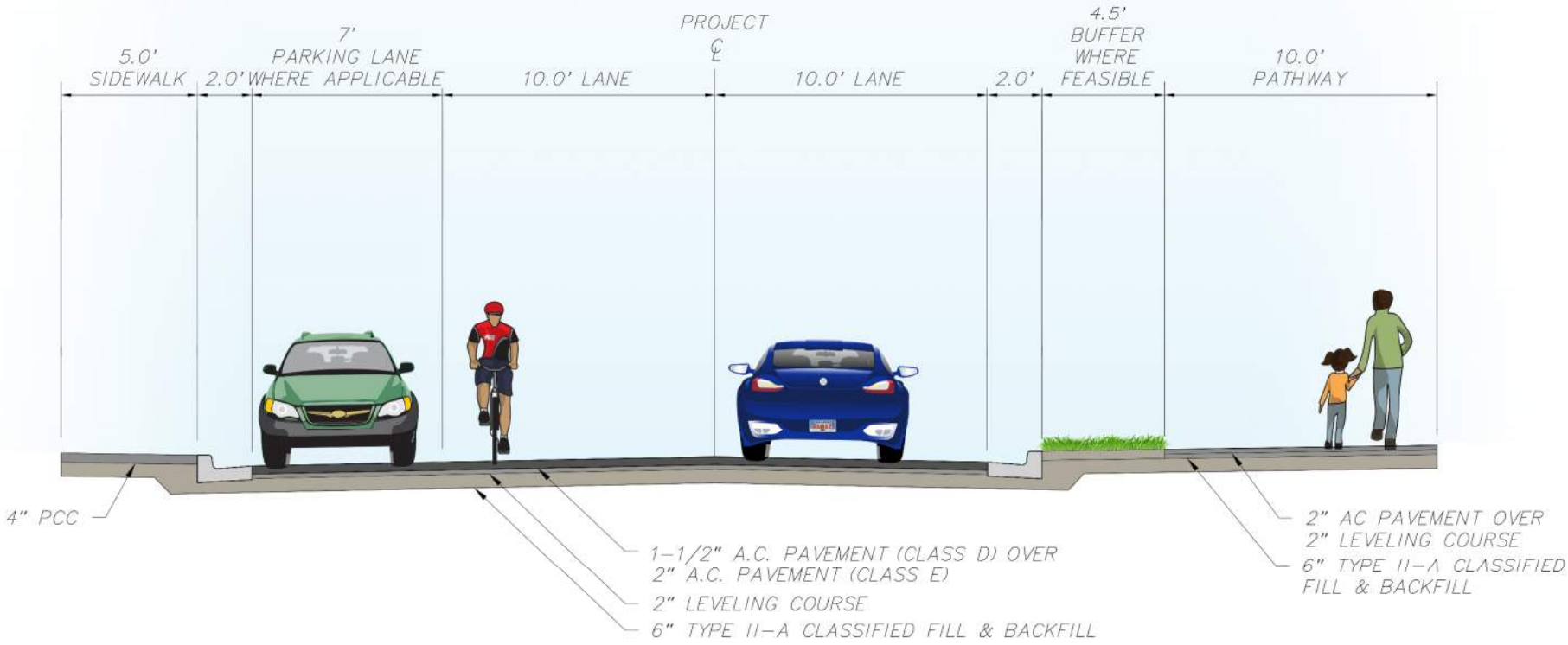

FIGURE 12 – TYPICAL ROADWAY STRUCTURAL SECTION, 2ND AVENUE

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Terminus of Coastal Trail at 2nd Ave. and H St. looking east

Constructing an at-grade paved pathway with a retaining wall, instead of a bridge, to accommodate the change in elevation between the substation and 2nd Avenue was investigated. However, the substation is located on an active contaminated site as well as a seismically sensitive bluff. Disturbances to the ground in this area would require additional ADEC coordination and possibly a Phase I and/or II ESA. Impacts and cutting of the slopes would require additional geotechnical review, analysis, and design to mitigate the sensitivity of the bluff. Thus it is assumed that the bridge will be replaced with a new bridge to minimize impacts to the contaminated site and sensitive slopes. ML&P may be decommissioning and removing the existing substation which could allow expanded fill slopes and thus possibly avoid installation of a new bridge.

The Red Route, Option 1 requires the trail user to cross five streets: Christensen Drive, F Street, C Street, 1st Avenue, and Ship Creek Avenue. Christensen Drive is a steep road with the downhill grades travelling northward. There have been 6 intersection related vehicle crashes from 2005 – 2014. Additional safety measures and/or signage for this intersection would be important to warn the vehicle user of the upcoming trail crossing and the trail user of the approaching intersection. A raised intersection was investigated but because of the steep grades of the approaching roadways would most likely not be feasible.

The intersection of 2nd Avenue and E Street can be visually confusing to a vehicle, although there have been no intersection related crashes there from 2005 – 2014. At 3rd Avenue, E Street is one-way north bound only. But between 3rd Avenue and 2nd Avenue, E Street is two way. South bound left turning traffic on E Street and east bound traffic from 2nd are stop-controlled but south bound right turning traffic on E Street and west bound traffic on 2nd Avenue are free-flowing. This change in one-way to two-way combined with the non-standard stop-controlled configuration and large radius slip turn lane creates confusion for a driver. This intersection was studied in 2007 as part of the E Street Corridor Enhancement Project and was recommended to remove the slip-lane and provide a standard three-way stop control. The location that the Red Route crosses 2nd Avenue is separated from this intersection to reduce the

Existing intersection of E St. and 2nd Ave. looking north

confusion and potential conflicts with turning movements at 2nd Avenue and E Street.

The existing grades along 2nd Avenue down the hill are approximately 6.5%. The Americans with Disability Act (ADA) allows side-path grades to follow roadway grades, even if the grades are greater than 5%. However, resting landings should be incorporated into steep hill side-paths where feasible. Further investigation into incorporating resting landings will be investigated during design.

There are four at-grade railroad track crossings with Red Route, Option 1. While three of these railroad tracks are primarily used by passenger trains arriving or departing from the depot, the fourth track is the mainline railroad track that bypasses the freight yard. Coal or gravel trains travel regularly at full track speed (20 mph) through this area. Other freight trains travel through here to serve the industry tracks on the south side of Ship Creek.

This section of C Street, from 1st Avenue to Ship Creek Avenue, was recently upgraded and includes wide pedestrian facilities on both sides of C Street and track crossing safety measures. The railroad track crossings are all within a 100-foot length of sidewalk and thus are grouped into a single crossing zone for safety and mitigation measures. Pedestrian channelization fences were installed in the sidewalks with "LOOK" signs to encourage pedestrians to slow down and look before crossing the tracks. Additionally, a bicyclist would need to dismount or significantly reduce their travel speed to travel along the sidewalk through the channelization fences, increasing their awareness of any oncoming trains. This crossing zone also includes flashing signals and gates.

Although this route requires a high number of roadway crossings and railroad track crossings, the route is an expected route that many pedestrians and bicyclist currently use to travel between the Coastal Trail and Ship Creek Trail or even between downtown and the Ship Creek area. This route, which is expected and known, provides additional safety benefits over a new, unexpected route with unknown crossings of unknown travel modes.

This route provides the secondary benefit of connecting the Downtown area to the Ship Creek area with a direct route to Kings Landing but does not allow for a separation of trail users. Recreational, commuter, and tourist users must all use the same slow-speed turns for the street and railroad track crossings. Additionally, this route connects with the Ship Creek Trail at C Street and the trail user must then travel through an area of Ship Creek that is popular with anglers and their fishing poles and hooks.

Kings Landing at Ship Creek, near the terminus of Red Route, Option 1

There are no excessive utility impacts with this route. The following utilities are anticipated to be impacted and will require coordination and possible relocation: underground 35kv electric line (2 crossing locations), underground 4kv and 12kv electric lines, electric transformer at C

Street/Ship Creek Avenue, underground cable lines, underground fiber optic lines, underground gas lines, water fire hydrants and valves, sewer manholes, storm drains and manholes, and street lights.

The existing lights in the project area vary in type (pedestrian and street lighting), ownership (MOA, ARRC, and ML&P), age, and condition. The MOA owned pedestrian lights along 2nd Avenue are old and corroded and will require replacement. The ML&P owned street lights and ARRC owned pedestrian lights that are impacted by construction will require replacement.

ROW impacts are also limited and include mostly slope easements from the ARRC and six private owners along the north side of 2nd Avenue. East of E Street, 2nd Avenue is technically a "no-named road" and is located on ADOT&PF property. C Street north of 1st Avenue is located on ARRC property. Coordination and approval from ADOT&PF and ARRC would be required.

This route is the least expensive to construct and maintain as it is located adjacent to existing infrastructure and roadway-maintained areas.

15. B. 2. Red Route, Option 2 (2nd Avenue to Cordova Street)

Red Route, Option 2 follows the same alignment as Red Route, Option 1 until it reaches the existing mid-block crossing on 2nd Avenue at D Street extended (see FIGURE 11). Red Route, Option 2 proposes to utilize the existing mid-block crossing to cross 2nd Avenue, but re-align the crossing to be perpendicular to the roadway. This route then traverses the bluff between 2nd Avenue and Barrow Street then turns north and east to travel along 1st Avenue, Cordova Street, and Ship Creek Avenue to access Ship Creek Trail. The existing conditions along the Red Route, Option 2 are summarized below in TABLE 14.

Table 14. Existing Conditions along Red Route, Option 2

Roadway	ROW Width[1]	Pavement Width	Existing Pedestrian Facilities	Existing Curb & Gutter?	On-Street Parking Allowed?	Other
2nd Avenue – see Table 12						
Bluff (D St. to A St.)	ADOT&PF, ARRC	N/A	None	N/A	N/A	Seismically sensitive bluff; Quyana Park
1st Avenue	62 ft	28 ft	8 ft wide, north side only	North side only	Both sides	Closed, contaminated sites
Cordova Street	60 ft	33 ft	None	None	Unknown	
Ship Creek Ave.	70 ft	37 ft	None	None	Both sides	Paved frontages and minimal setback of adjacent businesses
Alley access to Ship Creek Trail	10 ft	None	None	N/A	N/A	Building appears to be encroaching in alley ROW

1. If no ROW exists, the property owner is listed.

The ideal elevation and profile for the trail along the bluff would have to be analyzed further to determine the best location that 1) accommodates the existing access road at C street which is higher in elevation than the adjacent bluff area, and 2) uses a maximum grade of 4% between the bluff and 1st Avenue. A trail with a grade of 4% is allowed use a horizontal curve radius of 100 feet but grades over 4% require a 225-foot curve radius. A larger curve radius (225-feet) would have significantly more impacts to adjacent properties.

Bluff and the A-C Couplet overpass, as seen from the maintenance access road, looking east

Recently constructed rain garden east of E St. and north of 2nd Ave (looking east)

Geotechnical considerations for construction along the seismically sensitive bluff must also be further investigated. This portion of the bluff has been buttressed with the attempt to stabilize the area during large seismic events, however it is generally thought that the area could still experience failure under large seismic shaking. If the bluff fails in this area, Red Route, Option 2 could experience the same failure as the bluff. However, no habitable structures or other hazardous infrastructure is planned (i.e. no retaining walls). The route is at the toe of the bluff in this area so if failure occurs, it would likely result in horizontal movement of the ground and the development of pressure ridges which would create upward vertical displacement.

This bluff area is also designated as Quyana Park in the Ship Creek Framework Plan and could require a Section 4(f) review and approval. Section 4(f) is a US DOT Policy Paper that supplements FHWA regulations governing the use of land from publically owned parks, recreation areas, or private or public historic sites for federal highway projects.

The current alignment for the Red Route, Option 2 utilizes an existing 10-foot wide alley ROW between Ship Creek Avenue and the Ship Creek Trail. There is an existing, undeveloped parcel owned by ARRC located approximately 160 feet west of the alley ROW (approximately 60 feet east of Cordova Street). The ARRC parcels east of Cordova Street south of Ship Creek Avenue are also undeveloped. During the design phase, coordination with the ARRC would occur to

determine if an undeveloped parcel could be used for the trail connection to help reduce the sharp turns.

Alley access, looking north from Ship Creek Ave., currently being used for outdoor eating by the adjacent building (from Google Earth).

Possible location for connection to Ship Creek Trail, looking north towards undeveloped ARRC parcel from Ship Creek Avenue, approximately 75 feet east of Cordova Street.

Proposed conditions for the Red Route, Option 2 are summarized in TABLE 15.

Table 15. Proposed Conditions for Red Route, Option 2

Location	Trail location	Impacts to on-street parking	Other
2nd Avenue: H Street to crossing – see Table 13			
Crossing	At existing marked crossing for the "Salmon Run" stairs	None	Re-align crosswalk perpendicular to roadway; low speed, 90° turns required at crossing
Crossing to bluff	South side, attached to back of curb	Loss of 390 feet of bus parking	Relocate south curb to avoid impacts to rain garden (see picture)
Bluff (D St to A St.)	Traversing bluff then turning north at A St. ROW extended	N/A	Access road at C St. ROW needs to be maintained
1st Avenue	Reduce south lane width to 12 ft; install curb and gutter	Loss of 475 feet of non-metered, on street parking	Maximum pathway grade of 4% allowed at turns

Location	Trail location	Impacts to on-street parking	Other
Cordova Street	Reduce east lane width to 12 ft; install curb and gutter	Unknown	low speed, 90° turns required at intersection
Ship Creek Ave.	Reduce north lane width to 12 ft; install curb and gutter	Loss of 200 feet of non-metered, on street parking	low speed, 90° turns required at intersection
Alley access to Ship Creek Trail			low speed, 90° turns required at edge of building/ alley

The Red Route, Option 2 requires the trail user to cross six streets. The existing building on the southeast corner of 1st Avenue and Cordova Street impedes the available sight distance for north bound vehicles on Cordova Street. The trail location is proposed to be located north of the existing edge of traveled way along 1st Avenue to increase the visibility of a pedestrian at this intersection.

There are two at-grade railroad track crossings, located along Cordova Street. These tracks carry both passenger trains travelling at slow speeds in close proximity to the ARRC Depot but also freight trains that traverse through this area at full speed (20 mph). The two railroad tracks are 20 feet apart and can be grouped together into a single crossing zone for safety and mitigation measures. There are currently flashing lights and gates at this location but additional safety measures, similar to the channelization fences found on C Street should be installed. There is an out-of-service track at this location but it is not clear to the user if they are required to cross two or three active tracks. A sign located at 1st Avenue and Cordova Street indicates a crossing of four tracks. Signs within the project area should also be updated to correctly reflect the number of active track crossings at this location.

Existing railroad track crossing at Cordova St., north of 1st Ave.

This route provides the secondary benefit of not requiring the trail user to pass through the often congested and angler-filled area of Ship Creek. The tourist or recreational user could still use the existing facilities along 2nd Avenue and C Street to access the Ship Creek area while the commuter or long-distance trail user could by-pass the slower speeds of the recreational or tourist user in the main Ship Creek basin. However, the higher-speed commuter or long-distance trail user would still be required to travel along multiple streets and reduce their travel speed at the sharp, 90° turns at 1st Avenue, Cordova Street, and the alley access. Additionally, this route traverses through an industrial area with truck parking lots and paved lot frontages, making it difficult to distinguish between the vehicle travelled way and pedestrian route. Many of the existing buildings and parking lots are set very close to the ROW, reducing visibility for vehicles and pedestrians.

There are no excessive utility impacts with this route. The following utilities are anticipated to be impacted and will require coordination and possible relocation: underground 35kv electric line (3 crossing locations), overhead 35kv electric line (1 crossing location), underground 4kv and 12kv electric lines, underground and overhead electric lines, underground and overhead cable lines, underground and overhead fiber optic lines, underground gas lines, water fire hydrants and valves, sewer manholes, storm drains and manholes, and street lights.

Along 2nd Avenue west of E Street, ROW impacts are minimal and include mostly slope easements from the ARRC and six private owners along the north side of 2nd Avenue (like Red Route, Option 1). East of E Street, 2nd Avenue is technically a "no-named road" and is located on ADOT&PF property. The bluff between E Street and Barrow Street is owned by ADOT&PF and the ARRC. The parcels along 1st Avenue are mostly owned by ARRC. The parcel at the southeast corner of 1st Avenue and Cordova is privately owned and the building is in very close proximity to the ROW. Coordination with and approval from ADOT&PF and ARRC and coordination with the private owner at 1st Avenue/Cordova Street would be required.

This route is the 2nd least expensive to construct and maintain as it is mostly located adjacent to existing infrastructure and roadway-maintained areas. The bluff crossing would require trail specific maintenance vehicles and methods and the new curb and gutter along the eastern portion of this route could alter current plowing methods.

Due to the multiple street crossings, multiple sharp/right-angle turns, the industrial area, limited visibility at 1st Avenue/Cordova Street, construction on a seismically sensitive bluff, construction on a possible Section 4(f) park, and required improvements to the at-grade railroad crossing, the Red Route, Option 2 is not recommended.

15. B. 3. Green Route

The Green Route connects to the existing Coastal Trail at the top of the hill at L Street extended and then crosses existing ARRC property, the main and passenger railroad tracks, and the rail yard to connect with the Ship Creek Trail at the south edge of Ship Creek, west of C Street (see FIGURE 13). The Green Route requires the trail user to cross one street, C Street. This is an existing marked crossing used to connect the Ship Creek Trail on either side of C Street. No improvements would be needed at this trail crossing.

The Green Route requires no at-grade track crossings for the trail user. All tracks are crossed with an elevated pedestrian sky-bridge. The conceptual alignment of the Green Route is shown in more detail in Appendix C. Final alignment would require coordination with the ARRC to ensure they sky bridge does not impede the views from the proposed development south of 2nd Avenue and west of Christensen Drive (the "Downtown Edge" development").

The sky bridge is anticipated to be an architectural bridge due to its length, prominent location near downtown, and potential to be a destination in itself. The bridge will be designed to MOA DCM requirements, rated for a 12,000 pound Design Vehicle, and placed on new foundations. Foundations will be deep-pile foundations with reinforced concrete filled pipe piles below grade, extending up to the underside of the bridge. Bridge spans are assumed to be 100 feet long, but can be varied to avoid interferences at or below grade. All sections of the bridge and boardwalk will be well above the 100-year flood plain. For seismic ductility, the pile cap will be keyed into the top of the piling per AKDOT Alaska Bridges & Structures Manual (dated April 2016).

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SMALL BOAT LAUNCH

SMALL BOAT LAUNCH ROAD

WHITNEY ROAD

CONNECT TO SHIP CREEK TRAIL

SHIP CREEK

APPROX. LIMITS OF GRADING

25+00

22+50

20+00

17+50

15+00

12+50

10+00

7+50

5+00

2+50

0+00

FREIGHT TRACKS

PROPOSED PAVED TRAIL

PROPOSED SKY BRIDGE

NORTH C STREET

CLEAR OFFSET FROM TRACK (INCREASED AT OUTSIDE OF CURVE) TYP.

ACCOMMODATION FOR FUTURE TRACK, TYP.

ARRC RAIL YARD

SHIP CREEK AVENUE

ARRC ACCESS ROAD

PASSENGER TRACKS

ARRC DEPOT

1ST AVENUE

GREEN ROUTE

ML&P SUBSTATION

CONNECT TO COASTAL TRAIL

EXISTING COASTAL TRAIL BRIDGE

2ND AVENUE

H STREET

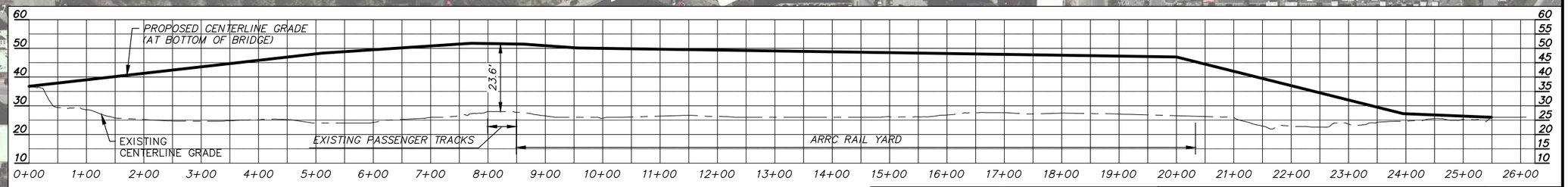
F STREET

E STREET

CHRISTENSEN DRIVE

MAINTENANCE ACCESS ALLEY

L STREET



0 50 100 200 Feet
1:1200

PROJECT: 10132.00
STATUS: CONCEPT

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MUNICIPALITY OF ANCHORAGE

DOWNTOWN TRAIL CONNECTION
COASTAL TRAIL TO SHIP CREEK

GREEN ROUTE

OVERVIEW PLAN LAYOUT

DATE: MAY 2017
SCALE: 1"=100'
FIGURE: 13

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There are multiple styles of bridges that can be used to span the 100-foot piling spacing and a variety of styles can be used together to create architectural appeal and landmark status. Shown below, at Chambers Bay in Pierce County Washington, is a post-tensioned concrete box-girder bridge. For the center span, the railings were extended higher to create the impression of a long-span truss.

Example of post-tensioned concrete box girder pedestrian sky bridge at Chambers Bay over the Cascades Railroad, Pierce County WA (from Chambers Bay website)

Given the commonly available materials in Anchorage, a steel girder bridge, steel H-truss bridge, or pre-stressed concrete girder bridge is recommended.

The steel H-truss uses the railings as structural truss members and therefore minimizes the total weight and cost of the bridge. The side trusses will be at-least 9 feet tall for a 100-foot span and can be customized to position the top of the truss at the needed height to act as a railing. This allows the shape of the bridge to be dramatic in certain areas, lowering the top rail to the minimum 5 feet above the trail surface and placing the remaining 4 feet of the truss below the surface. This style of bridge is the most economical and can be prefabricated by multiple companies (such as Big R Bridge). This style of bridge is currently in wide use along the Coastal Trail and throughout Southcentral Alaska. The deck of the bridge is formed with concrete on metal deck with an asphalt wearing surface over the top that can be periodically replaced. This option is included in the attached estimate.

Example of steel H-truss bridges

Example of pre-manufactured bridge from Big R Bridge

The steel girder bridge locates all the steel below the deck of the bridge. This makes the sight lines from the bridge very appealing, allowing the railing to be architectural in nature and shaped to direct the view-scapes. The deck of the bridge is formed with concrete on metal deck, with an asphalt wearing surface over the top that can be periodically replaced. This option will increase the bridge cost by 20% over the standard in the estimate.

Example of a steel girder bridge

The pre-stressed concrete girder bridge positions the structural concrete member underneath the bridge deck to allow freedom with the railing arrangement. Each span can be pre-poured and stressed in Anchorage and transported to the sight and lifted into place. This style of bridge is common for highways and can either have the deck poured integrally with the girder (forming a T-shape) or the concrete deck can be poured in place after erection. In either case, an asphalt wearing surface can be placed over the top of the concrete deck. This option will increase the bridge cost by 30% over the standard in the estimate.

Example of a concrete girder bridge

The bridge will maintain a clear height of 23.5 feet from top of rail (existing or future) to bottom of bridge. Additionally, the sky bridge will maintain the 23.5-foot clearance above the majority of the rail yard for accommodation of possible future expansions and tracks. This allows the ARRC the greatest flexibility in their operations and improvements to their rail yard. All piers will be placed outside of the track clear zones. Preliminary geotechnical engineering analysis indicates pier depth below existing grade should be 90 feet to extend through the soft, low-strength estuarine deposit soil layer and into the underlying Bootlegger Cove Formation layer. The piles would extend to the underside of the bridge deck.

Measures to prevent railroad trespass along the portion of the at-grade trail that parallels the north side of the rail yard will include a continuous fence at least 6 feet in height. On the sky bridge, the fence will be a minimum of 10 feet high, or 8 feet high if curved inward at the top. The bottom 5 feet of the fence would be “closed railing” design with no openings to prevent snow falling on the tracks.

This route provides the secondary benefit of connecting the Coastal Trail to the Ship Creek Trail and area through a user-friendly and unique trail experience. The pedestrian sky bridge would be an enjoyable experience for the trail user and act as a destination in itself for the views overlooking Cook Inlet. The route allows for large horizontal radii which can accommodate a high-speed commuter, although they would be sharing the trail with tourist and recreational

users who often travel at slower speeds. The high-speed commuter would still be required to pass through the congested area of Ship Creek that is popular with anglers. Maintenance of the bridge would be more extensive than the Red Routes due to snow removal requirements (snow cannot be plowed over the edge of the bridge onto ARRC property), bridge maintenance, and pier maintenance.

Utility Impacts with the Green Route include locating the piers to avoid the existing utilities in the rail yard. Existing utilities that cross the Green Route are: an underground electric line, underground gas lines, underground cable lines, storm drain lines and structures, a water line and valve, sewer lines and a manhole, an underground fiber optic line, an overhead cable line, and an overhead 35kv electric line and utility pole. The overhead cable lines would either need to be avoided or relocated.

ROW Impacts with this Route are solely with the ARRC and would include aerial easements for the bridge and land easements for the piers and access to the piers. Close and extensive coordination with and permitting from the ARRC would be required to ensure the final bridge route and pier locations do not impede their work flow in the rail yard.

The ARRC rail yard is an active contaminated site and work in the rail yard would require additional ADEC coordination and possibly a Phase I and/or II ESA.

This route is the most expensive to construct and 2nd most expensive to maintain. The separated trail would require trail specific maintenance, access, and emergency vehicles and methods. The depth of piers is assumed at 90 feet based on existing geotechnical analysis but if the piers are required to be deeper, the cost of the bridge could increase significantly.

15. B. 4. Blue Route

The existing conditions along the Blue Route consist of coastal mud flats, the Small Boat Launch, ARRC property, and the south bank of Ship Creek. The Coastal Trail south of Elderberry Park is located approximately 80 feet outboard of the railroad tracks. There is an ARRC access road that runs parallel to the tracks, offset from the tracks by 25 to 30 feet beginning approximately 1050 feet north of Elderberry Park. This access road continues to the Small Boat Launch. The area of the Small Boat Launch that the Blue Route crosses is ARRC property and consists of the gravel access road and the adjacent truck trailer storage areas. There are no existing curbs or gutters or pedestrian facilities within the Blue Route.

Aerial view of the coastal trail and ARRC rail yard. The Coastal Trail crosses underneath the railroad tracks in the bottom right side of the photo.

Along the coast, the Blue Route is proposed to be 80 feet outboard of the railroad tracks to match existing

conditions (see FIGURE 14). The trail would be constructed at a minimum elevation of 27.8 feet, like the existing trail, to prevent flooding or water on the trail at high tide. The trail would be constructed on an armored bank, separated from the tracks and access road by a drainage ditch. This drainage ditch also acts as a measure to prevent railroad trespass. When the trail joins the existing embankments and pavement at the Small Boat Launch, a continuous fence at least 6 feet in height will be constructed the entire length of the trail, except at the crossing.

The Blue Route connects to the existing gravel footpath along the south bank of Ship Creek east of the railroad bridge. Portions of this trail are underwater at high tide and thus the proposed trail is re-constructed at a minimum elevation of 24.5 feet to prevent flooding at high tide. The trail is also located south of the existing gravel path, but not on ARRC property, to minimize fill in the creek. An armored, reinforced bank should be installed at locations where the fill extends to onto the existing slope to prevent erosion of the embankment.

Existing gravel foot path along south bank of Ship Creek, west of C Street at high tide with portions underwater

The Blue Route requires the trail user to cross one street, C Street. This is an existing marked crossing used to connect the Ship Creek Trail on either side of C Street. No improvements would be needed at this trail crossing.

Existing marked crossing for the Ship Creek Trail at C Street

An additional roadway crossing does occur at the paved, ARRC access road at the Small Boat Launch but this road is a private, maintenance access and use only road and is not considered in the “roadway” crossings.

The Blue route requires the user to cross one railroad track at-grade. This railroad track is the main freight serving the Anchorage yard. The track crossing was placed as far south as possible to minimize occurrences of bi-directional train movement at the crossing location. The crossing of the ARRC access road and the freight main were combined at the same location to create one crossing zone for safety and mitigation measures. Flashing lights and gates should be installed at the crossing. The trespass mitigation fence that would be installed along the trail would also function as a channelization fence to ensure trail users cross at the designated, marked location.

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1:1500

PROJECT: 10132.00
STATUS: CONCEPT

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MUNICIPALITY OF ANCHORAGE

DOWNTOWN TRAIL CONNECTION
COASTAL TRAIL TO SHIP CREEK

BLUE ROUTE

OVERVIEW PLAN LAYOUT

DATE: MAY 2017
SCALE: 1"=125'
FIGURE: 14

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ARRC maintenance access road at the Small Boat Launch, looking southwest, at approximate location of Blue Route's at-grade crossing

This route provides the secondary benefit of connecting the Coastal Trail to the Ship Creek Trail and area through a coastal, waterfront route for scenic, wildlife, and recreational purposes. The coastal, outboard route would be an enjoyable experience for the trail user and provide views of Cook Inlet.

North of the track crossing, the trail user is required to travel between the railroad tracks and the rail yard. There was concern expressed at the SWGs and the Open House that this would not be perceived as safe or comfortable for the trail user. Additional crime and trespass mitigations measures to alleviate these concerns should be considered if the Blue Route is chosen.

This route does not provide for a separation of trail users and recreational, commuter, and tourist users must share the trail and all use the slow-speed turns at the access road/railroad track crossing. This route connects with the Ship Creek Trail near the mouth of Ship Creek and all trail users must travel through the full area of Ship Creek that is popular with anglers.

Maintenance for the Blue Route would be the most extensive of the alternatives due to the coastal and creek side location. The embankment armoring would need upkeep and monitoring. Because portions of the trail would be constructed on undeveloped intertidal areas, settlement of 1 to 2 feet could occur over several years, requiring additional maintenance or even reconstruction. Constructability on soft coastal ground needs to also be considered in the design and construction phasing. Erosion and drainage management would be required along Ship Creek, even though the trail is located above high tide.

There is a large sewer interceptor line located along the proposed coastal trail route. The existing Coastal Trail is located above this sewer line but further coordination with AWWU would be required to ensure adequate access to their sewer line is maintained. Two storm drain systems outfall to Cook Inlet along the coastal route. These systems would need to be extended to allow the storm water to outfall on the outboard (coastal side) of the new trail embankment.

North of where the trail connects to the Small Boat Launch, utility impacts are expected to be minimal. The following utilities are anticipated to be impacted in this area and will require coordination and possible relocation: underground 35kv electric line (1 crossing locations), overhead 35kv electric line (1 crossing location), underground 4kv and 12kv utility lines and structures, underground cable lines, storm drain lines and structures, storm drain culverts at Ship Creek, water valves, and sewer manholes.

Improvements for the Blue Route are entirely located on coastal lands, waterways, and ARRC property. Extensive coordination with and permitting from the ARRC would be required to obtain approval for adding an at-grade track crossing. ARRC has expressed their resistance to at-grade crossings of railroad freight tracks, especially at locations of potential bi-directional train movement. Improvements within the rail yard would need to ensure workflow and future development are not hindered.

The Blue Route also requires extensive additional permitting. Work within the coastal zone will require a Section 404 permit and work that impacts areas below the MWH require a Section 10 permit from the USACE. A Title 16 Fish Habitat Permit is required from ADF&G for work that impacts Ship Creek and a consistency review is required by either the State of Alaska or MOA for work along the coastal management zone. The ARRC rail yard is an active contaminated site and any work in the railyard would require additional ADEC coordination and possibly a Phase I and/or II ESA. If the project is federally funded, and EA and possibly and EIS would be required.

Although the extension of the Coastal Trail along the outboard (coast side) would provide a secondary benefit of a waterfront route, the Blue Route is not recommended due to the maintenance, constructability, safety concerns with the trail between the railroad tracks and the rail yard, at-grade crossing of a railroad freight main, ROW coordination issues, and permitting issues with construction in Knik Arm.

15. B. 5. Comparison Chart

The analyses discussed above are summarized in a matrix alternative comparison chart show in TABLE 16.

Table 16: Level 2 Analysis - Alternatives Comparison Chart

● Positive ● Negative ○ Neutral

Criteria	Route Alternative			
	Red, Opt. 1 2nd to C St.	**Red, Opt. 2** 2nd to Cordova	**Green** Sky bridge at 2nd	**Blue** coastal to rail yard
Supports Ship Creek development & recreation	●	●	●	●
Costal access and/or views	●	●	●	●
Supports Downtown development and connection	●	●	○	●
Impacts/restrictions to future ARRC development	●	●	●	●
User perception of comfort (ex. separation from vehicles, hill grades, adjacent to rail yard)	●	●	●	●
Potential conflict between anglers and trail users	○	●	○	●
Street crossings(# of crossings)	● (5 crossings)	● (6 crossings)	○ (1 crossing)	○ (1 crossing)
At-grade, freight track railroad crossings(# of crossings)	● (0 crossings)	● (0 crossings)	● (0 crossings)	● (1 crossing)
At-grade, passenger track railroad crossings(# of crossings)	○ (4 crossings, see note 2)	● (2 crossings, see note 2)	● (0 crossings)	● (0 crossings)
Diagnostic Team review required for new at-grade crossing	●	●	●	●
Drainage issues with high-tide levels at Ship Creek	●	●	○	●
Land acquisition costs/potential complications	●	●	●	●
Permitting - ARRC	●	●	●	●
Permitting - ADEC, ADF&G USACE	●	●	○	●
Utility impacts/relocation costs	○	○	●	○
Construction costs	●	○	●	○
Maintenance costs and ease of access	●	●	○	●

1. Positive/Negative/Neutral ratings were given relative to the other route options
2. Red Route Opt 1 already has established crossing safety measures in-place but Red Route Opt 2 requires upgrades to the crossing.

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16. ANCILLARY TRAIL IMPROVEMENTS

16. A. Signing and Striping

Each of the alternatives would include appropriate signing and striping to direct trail users and warn of any upcoming potential hazards, such as road or track crossings. If trail users are over 1,000 per day or there is limited sight distance, roadway crossings will include zebra style pavement crossing. Steep grades, approaching track or roadway crossings, wayfinding, and any other applicable signage would be included. Wayfinding signage will adhere to the *Anchorage Trails Design Intent Drawings* dated July 5, 2015.

16. B. Illumination & Signalization Improvements

The trail is recommended to be illuminated along its entire length. Pedestrian style lights that are consistent with the *Ship Creek District Design Guidelines* should be used. The *Ship Creek District Design Guidelines* states that "street lighting should use poles similar to those used in the Anchorage Downtown Area" and "Decorative pedestrian light fixtures … should be compatible with the style of lights at Ship Creek Plaza." The decorative pedestrian lights at Kings Landing, Phase 2 are a pendant style lighting manufactured by Cyclone, which is different than the current pedestrian lighting along 2nd Avenue.

Flashing lights would be installed at any at-grade rail crossings.

Existing pedestrian lights along 2nd Avenue (left) and at King's Landing (right).

16. C. Landscaping & Site Amenities

Landscaping will be included in whichever alternative is selected. At a minimum, landscaping will be in accordance with the *Ship Creek District Design Guidelines* and *Title 21*. Landscape design will analyze and integrate trail safety, accessibility, views, habitat, recreational uses, and potentially educational and interpretive opportunities.

The Red Route alternatives may consider a gateway or wayfinding features that call attention to the E Street Pedestrian Corridor and C Street/Ship Creek Avenue intersection. The gateway/ wayfinding features would indicate entry to and from the Ship Creek district.

Site amenities such as benches, trash receptacles, railing, specialty paving, etc. may be desired depending on opportunities that the selected alternative provides. These amenities might be associated with viewing/rest nodes along the trail, sky bridge (Green route), or similar spaces such as public plazas. Site amenities and landscaping will respect existing themes established along Ship Creek Trail, West 1st Avenue, and King's Landing.

The sign panels and kiosks proposed in the Ship Creek Trail Signage Plan with in the project area should be incorporated into this project or removed, protected, and reinstalled if this project is constructed before the Trail Signage Plan.

17. COST ESTIMATES

Conceptual costs for the various alternatives are shown below in TABLE 17 . More detailed information of the conceptual cost estimate can be found in APPENDIX B. For estimating purposes, the structural section for the paved trail over undeveloped areas includes 2 inches of AC pavement over 2 inches of leveling course over 1.5 feet of classified fill. For improvements within existing developed ROW, the structural section was based on the recommended structural section for the E Street Enhancements project, which also constructed improvements in existing developed ROW within the downtown area: 2 inches AC pavement over 2 inches leveling course over 6 inches classified fill. Roadway improvements would include an additional 1.5" of AC pavement for a total pavement depth of 3.5 inches of pavement. The Green Route assumed the sky bridge would be a steel H-truss girder bridge with a concrete-on-metal deck with 2 inches of asphalt over the concrete.

Table 17. Conceptual Cost Estimate

Alternative	Construction Costs	Utility Relocation Costs	Permit Costs (estimate)	ROW Acquisition Costs	Total
Red Route, Opt. 1	$2,784,000	$40,000	None	$10,000	$2,834,000
Red Route, Opt. 2	$3,532,000	$40,000	None	$10,000	$3,582,000
Green Route	$15,080,000	None	$15,000	all ARRC property	$15,095,000
Blue Route	$8,740,000	$40,000	$25,000	all ARRC property	$8,805,000

18. CONCLUSIONS AND RECOMMENDATIONS

Based on the above analysis, there are two proposed recommendations:

1. Near term improvements: Red Route, Option 1
2. Long term improvements, or as soon as funding allows: Green Route

These alternatives provide the best balance of meeting project needs, providing secondary benefits, minimizing conflicts with multi-modal users or providing appropriate mitigation measures, costs, avoiding drainage issues, and permitting requirements.